CH2M HILL
2485 Natomas Park Drive
Suite 600
Sacramento, CA
95833-2937
Tel 916.920.0300
Fax 916.920.8463

CH2MHILL

June 12, 2001

01-AFC-4

CALIF ENERGY COMMISSION

JUN 13 2001

RECEIVED IN DOCKETS

Ms. Cheri Davis
California Energy Commission
Energy Facilities Siting and Environmental Protection Division
1516 Ninth Street, MS-15
Sacramento, CA 95814

Subject: East Altamont Energy Center Application for Certification
Data Adequacy Response Set 5 (01-AFC-04)

Dear Ms. Davis:

Enclosed are 125 copies of the East Altamont Energy Center Application for Certification Data Adequacy Response Set 5. The enclosed response includes the remaining Water Resources information that the Commission staff requested on the potable waste discharge requirements and the Report of Waste Discharge (ROWD) permit application. The ROWD was submitted to the Central Valley Regional Water Quality Control Board on June 11, 2001, as evidenced by the date/time stamp on the ROWD transmittal letter.

If you have any questions, please call me at 916-920-0300.

Sincerely,

CH2M HILL

Jerry Salamy

Jerry Salamy
Project Manager

c: Alicia Torre/Calpine
Steve DeYoung/Calpine
Jim McLucas/Calpine
EJ Koford/CH2M HILL
Nancy Werdel/WAPA
Chris Cochran/CVRWQCB

CALPINE

WESTERN REGION OFFICE
6700 KOLL CENTER PARKWAY
SUITE 200
PLEASANTON, CALIFORNIA 94566
925.600.2000
925.600.8924 (FAX)

June 12, 2001

Mr. Victor J. Izzo
Senior Engineering Geologist
California Regional Water Quality Control Board
Central Valley Region
3443 Routier Road, Suite A
Sacramento, CA 95827-3015

Dear Mr. Izzo:

Please find enclosed for filing a Report of Waste Discharge (ROWD) for the East Altamont Energy Center and a check in the amount of $3,000.00 for filing fees.

We have prepared this ROWD to provide all of the information required by the Board to apply for waste discharge requirements for the East Altamont Energy Center. To assist your initial review of this ROWD, we have attached to the ROWD a summary of the information requirements for a Report of Waste Discharge with specific reference to where this information is provided in the ROWD. Should you have any questions or require additional information on this matter, please contact Jim McLucas of Calpine at (925) 931-1428, extension 32.

Sincerely yours,

Alicia Torre

Alicia Torre
Project Development Manager
East Altamont Energy Center

cc: Jim McLucas
Steve DeYoung

Summary of Compliance Information for Title 27, Section 21750

Section 21750 Citation	Information Required	Reference Section in Report of Waste Discharge
(a) Identify Potential Impairments	Proposed Waste Discharges and Effects on Surface and Groundwater	Sections 1.1, 1.2, 1.3 and 1.4 on pages 1-1 - 1-4
(b) Support Proposed Classification	Unit Classification Information	Section 2 – Waste Management Unit (Evaporation Ponds) on pages 2-1 – 2-3
(c) Restate, Where Appropriate	Documentation	Referenced information is completely incorporated herein and is not simply incorporated by reference.
(d) Topography	(1) Topographic Map	Section 3, Figure 3-1, page 3-2
	(2) Floodplain	Section 3, Figure 3-2, page 3-3
(e) Climatology	(1) Isohyetal Map	Section 4, Figure 4-1, page 4-5
	(2) Precipitation	Section 4, Table 4-1, page 4-1
	(3) Design Storm	Section 4.3, page 4-1
	(4) Evapotranspiration	Section 4.4, Table 4-3, page 4-4
	(5) Runoff Volume	Section 4.5, page 4-4
	(6) Wind Rose	Section 4.6, Figures 4-2, 4-3, and 4-4, pages 4-6 – 4-8
(f) Geology	(1) Maps and Cross-Sections	Figures 5-1 and 5-2, pages 5-6 and 5-7
	(2) Materials	Section 5.2, page 5-1
	(3) Geologic Structure	Section 5.3, page 5-1
	(4) Engineering and Chemical Properties	Section 5.4, page 5-2
	(5) Stability Analysis	Section 5.5, page 5-2
	(6) Fault Identification and Proximity	Section 5.6, page 5-4
(g) Hydrogeology	(1) General	Covered throughout Section 6 – see specific subsections
	(2) Hydraulic Conductivity	Not applicable because Unit will be double lined with LCRS (per CVRWQCB guidance)
	(3) Flow Direction	Section 6.2, Figure 6-1, page 6-7
	(4) Capillary Rise	Section 6.3, page 6-2
	(5) Springs	No known springs in proximity of project site
	(6) Water Quality	Section 6.5, page 6-2
	(7) Background	Constituents of Concern (CoCs) will be determined based on data from quarterly sampling of wells upgradient the Unit for 1 year. Per CVRWQCB guidance, the results of this monitoring program will be submitted under separate cover for review and approval prior to operation of the Unit.
(h) Land and Water Use	(1) Well Map	Section 7.1, Figure 7-1, page 7-3
	(2) Well Owner	Section 7.2, page 7-1
	(3) Well Information	Section 7.3, page 7-1
	(4) Land Use	Section 7.4, page 7-1
	(5) Groundwater Use	Section 7.5, page 7-1
(i) Preliminary Closure Plan	Preliminary Unit Closure Plan and Generalized Closure Cost Estimate	Section 9, page 9-1

Report

Waste Discharge for the East Altamont Energy Center

Submitted to

Calpine Corporation

June 2001

CH2MHILL

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

I. FACILITY INFORMATION

A. Facility:

Name: East Altamont Energy Center			
Address: Intersection Mountain House and Kelso Road			
City: Unincorporated portion of Alameda County	County: Alameda	State: CA	Zip Code: 94566
Contact Person: Jim McLucas		Telephone Number: (925)931-1428	

B. Facility Owner:

Name: East Altamont Energy Center LLC			Owner Type (Check One): 1. ☐ Individual 2. ☒ Corporation 3. ☐ Governmental Agency 4. ☐ Partnership 5. ☐ Other:
Address: 6700 Koll Center Parkway, Suite 200			
City: Pleasanton	State: CA	Zip Code: 94566	
Contact Person: Alicia Tore		Telephone Number: (925)600-2000	Federal Tax ID: 77-0566240

C. Facility Operator (The agency or business, not the person):

Name: East Altamont Energy Center			Operator Type (Check One): 1. ☐ Individual 2. ☒ Corporation 3. ☐ Governmental Agency 4. ☐ Partnership 5. ☐ Other:
Address: -Same as Owner-			
City:	State:	Zip Code:	
Contact Person:		Telephone Number:	

D. Owner of the Land:

Name: The Holck Family (See attachment 1)			Owner Type (Check One): 1. ☒ Individual 2. ☐ Corporation 3. ☐ Governmental Agency 4. ☐ Partnership 5. ☐ Other:
Address: 323 Coronado Way			
City: Tracy	State: CA	Zip Code: 95376	
Contact Person: Donald Holck		Telephone Number: (209) 836-2932	

E. Address Where Legal Notice May Be Served:

Address: -Same as Owner-		
City:	State:	Zip Code:
Contact Person:		Telephone Number:

F. Billing Address:

Address: -Same as Owner-		
City:	State:	Zip Code:
Contact Person:		Telephone Number:

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

II. TYPE OF DISCHARGE

Check Type of Discharge(s) Described in this Application (A or B):

[X] **A. WASTE DISCHARGE TO LAND** [ ] **B. WASTE DISCHARGE TO SURFACE WATER**

Check all that apply:

- [ ] Domestic/Municipal Wastewater Treatment and Disposal
- [X] Cooling Water
- [ ] Mining
- [ ] Waste Pile
- [ ] Wastewater Reclamation
- [ ] Other, please describe: ____
- [ ] Animal Waste Solids
- [ ] Land Treatment Unit
- [ ] Dredge Material Disposal
- [ ] Surface Impoundment
- [ ] Industrial Process Wastewater
- [ ] Animal or Aquacultural Wastewater
- [ ] Biosolids/Residual
- [ ] Hazardous Waste (see instructions)
- [ ] Landfill (see instructions)
- [ ] Storm Water

III. LOCATION OF THE FACILITY

Describe the physical location of the facility.

1. Assessor's Parcel Number(s)	2. Latitude	3. Longitude
Facility: 099B-7100-003	Facility: 37-80N	Facility: 121.60
Discharge Point: -same-	Discharge Point: -same-	Discharge Point: -same-

IV. REASON FOR FILING

- [X] New Discharge or Facility
- [ ] Change in Design or Operation
- [ ] Change in Quantity/Type of Discharge
- [ ] Changes in Ownership/Operator (see instructions)
- [ ] Waste Discharge Requirements Update or NPDES Permit Reissuance
- [ ] Other: ____

V. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Name of Lead Agency: California Energy Commission

Has a public agency determined that the proposed project is exempt from CEQA? [ ] Yes [X] No

If Yes, state the basis for the exemption and the name of the agency supplying the exemption on the line below.

Basis for Exemption/Agency: ____

Has a "Notice of Determination" been filed under CEQA? [ ] Yes [X] No

If Yes, enclose a copy of the CEQA document, Environmental Impact Report, or Negative Declaration. If no, identify the expected type of CEQA document and expected date of completion.

Expected CEQA Documents: The CEC's certified regulatory program is CEQA equivalent.

[X] EIR [ ] Negative Declaration

Expected CEQA Completion Date: May 2002

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

VI. OTHER REQUIRED INFORMATION

Please provide a COMPLETE characterization of your discharge. A complete characterization includes, but is not limited to, design and actual flows, a list of constituents and the discharge concentration of each constituent, a list of other appropriate waste discharge characteristics, a description and schematic drawing of all treatment processes, a description of any Best Management Practices (BMPs) used, and a description of disposal methods.

Also include a site map showing the location of the facility and, if you are submitting this application for an NPDES permit, identify the surface water to which you propose to discharge. Please try to limit your maps to a scale of 1:24,000 (7.5' USGS Quadrangle) or a street map, if more appropriate.

See attached

VII. OTHER

Attach additional sheets to explain any responses which need clarification. List attachments with titles and dates below:

Attachment 1 - Clarification of legal land owner. Attachment 2 - Description of wastewater treatment processesand maps and diagrams requested in section IV.

You will be notified by a representative of the RWQCB within 30 days of receipt of your application. The notice will state if your application is complete or if there is additional information you must submit to complete your Application/Report of Waste Discharge, pursuant to Division 7, Section 13260 of the California Water Code.

VIII. CERTIFICATION

"I certify under penalty of law that this document, including all attachments and supplemental information, were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Print Name: James B. McLucas Title: Regional Engineer

Signature: [signature] Date: 6-8-01

FOR OFFICE USE ONLY

Date Form 200 Received:	Letter to Discharger:	Fee Amount Received:	Check #:

ATTACHMENT 1

Land Ownership

The land is currently owned by five members of the Holck family (Thelma Holck, Lorraine J. Andersen, Norman E. Holck, Donald J. Holck and Dale M. Holck) and the land is currently farmed by Donald Holck, whose phone number and address were provided for the contact person in section D. Calpine Corporation, the parent of East Altamont Energy Center LLC, usually holds land and option agreements through its wholly owned subsidiary, Anacapa Land Company LLC. Anacapa holds an option agreement with the Holck family and, upon permit receipt, will close on the land and transfer it to EAEC LLC's control prior to start of construction. The option agreement allows Anacapa and its agents to enter the land and perform tests and environmental assessments. Questions directed to the Optionee should be addressed to Alicia Torre at 925-600-2304.

All five owners and their individual addresses are:

Ms. Lorraine Anderson
8406 Terrace Drive
Stockton, CA 95212

Mr. Norman Holck
55578 Randal Road
Bandon, OR 97411

Mr. Dale Holck
671 Scarlett Place
Tracy, CA 95376

Mr. Donald Holck
323 Coronado Way
Tracy, CA 95376

Mrs. Thelma Holck
c/o Ms. Lorraine Anderson
8406 Terrace Drive
Stockton, CA 95212

Contents

Appendices

Tables

Figures

SECTION 1

Project Background

Calpine Corporation (Calpine) proposes to develop a natural gas fired electric power generating facility at the northeastern edge of Alameda County (see Figure 1-1). The proposed East Altamont Energy Center (EAEC) will be a high-efficiency, combined-cycle facility. The plant site would occupy up to 55 acres near the center of the 174-acre property, with the remainder available for lease as agricultural land.

Calpine is the sponsor of the EAEC, which will be owned by the East Altamont Energy Center Limited Liability Company (EAEC LLC), a wholly owned subsidiary of Calpine Corporation.

1.1 Description of Generating Facility

The generating facility will consist of three combustion turbine generators (CTGs) with heat recovery steam generators (HRSGs) and one steam turbine generator (STG), with a nominal total generating capacity of 1,100 MW. The turbines are expected to be General Electric PG 7251 (FB) units. One nominal 100,000-pound-per-hour auxiliary boiler will also be included to provide steam for auxiliary purposes. A 19-cell, mechanical-draft evaporative cooling tower will also be installed to provide cooling water for the steam turbine condenser. Additional auxiliary equipment will include a natural gas fired 1,000-kW emergency generator and a 370-horsepower (hp) diesel fire pump.

1.2 Proposed Schedule

Construction is planned to begin in June 2002 and to be completed by June 2004. Plant testing will commence in the first quarter 2004, and full-scale commercial operation is expected to commence in June 2004.

1.3 Description of Wastewater Management System

Process wastewater will be collected from all of the plant equipment, including the HRSGs, cooling tower, and water treatment equipment. The water balance flow diagram, Figure 1-2, shows the expected wastewater streams and average flow rates for the EAEC, assuming all water supplied to the EAEC is raw water from the Byron Bethany Irrigation District (BBID). Figure 1-3 presents the water balance flow diagram, assuming all water supplied to the EAEC is recycled water from the future Mountain House Community Services District Wastewater Treatment Plant (MHCSD WWTP) effluent. Since the EAEC is a zero-liquid discharge facility, process wastewater will be reclaimed and reused, to the extent possible. The leftover concentrated brine solution, high in total dissolved solids (TDS), will be directed to two 5-acre onsite evaporation ponds. A dual pond system will be used so that one pond can be taken out of service for maintenance. The evaporation ponds would receive a waste stream from the brine concentration of approximately 5 to 53 gallons per minute, depending on plant load and source water quality.

The only process wastewater generated by the EAEC will be concentrated brine solution that is routed to the two 5-acre evaporation ponds. However, a wastewater recycle pond and a stormwater detention pond will also be needed. The wastewater recycle pond will be used on an as-needed basis to temporarily hold water during times when the brine concentrator is taken offline for maintenance. Once the brine concentrator is brought back online, the water in the wastewater recycle pond will be routed back through the brine concentrator. The wastewater recycle pond may also be used to temporarily hold water if one of the evaporation ponds is taken offline for maintenance and the other evaporation pond does not have sufficient capacity to take all of the concentrated brine solution. Once the evaporation pond is brought back online, the water in the wastewater recycle pond will be transferred to the evaporation ponds and any significant accumulations of solids will be removed.

The other pond is the stormwater detention pond. This pond will accept non-contaminated stormwater runoff from the EAEC. The pond will be designed to discharge stormwater to an existing drainage ditch that runs along the east side of the site. Discharge flows will be metered such that the post-construction flow rates do not exceed pre-construction conditions. If stormwater flows exceed the capacity of the stormwater detention pond, then the excess non-contaminated runoff will be routed to the existing drainage ditch.

Since the wastewater recycle pond may accept brine solution, it is considered a waste management unit and its design and construction will be the same as the evaporation ponds. Since the stormwater detention pond will not accept contaminated runoff, it is not considered a waste management unit.

The evaporation ponds will be designed and engineered to meet the applicable surface impoundment requirements of the applicable section of Title 27 of the California Code of Regulations. Therefore, liquid wastes will be discharged to a Class II surface impoundment that is fitted with a double synthetic liner and leachate collection and removal system. Title 27 further stipulates that Class II units shall be designed, operated, and maintained to prevent inundation or washout caused by floods with a 1,000-year return period.

1.4 Waste Stream Characteristics

The industrial wastewater at the site will be recycled in a zero-liquid discharge treatment system. No industrial wastewater will be discharged off-site. Less than 53,000 gallons per day of concentrated brine will be discharged to on-site evaporation ponds. The quantity and quality of water discharged to the on-site evaporation ponds is dependent upon influent water quality. This water quality is anticipated to change as the facility begins receiving recycled water. Table 1-1 shows the estimated quality of brine flowing into on-site evaporation ponds under different source water regimes.

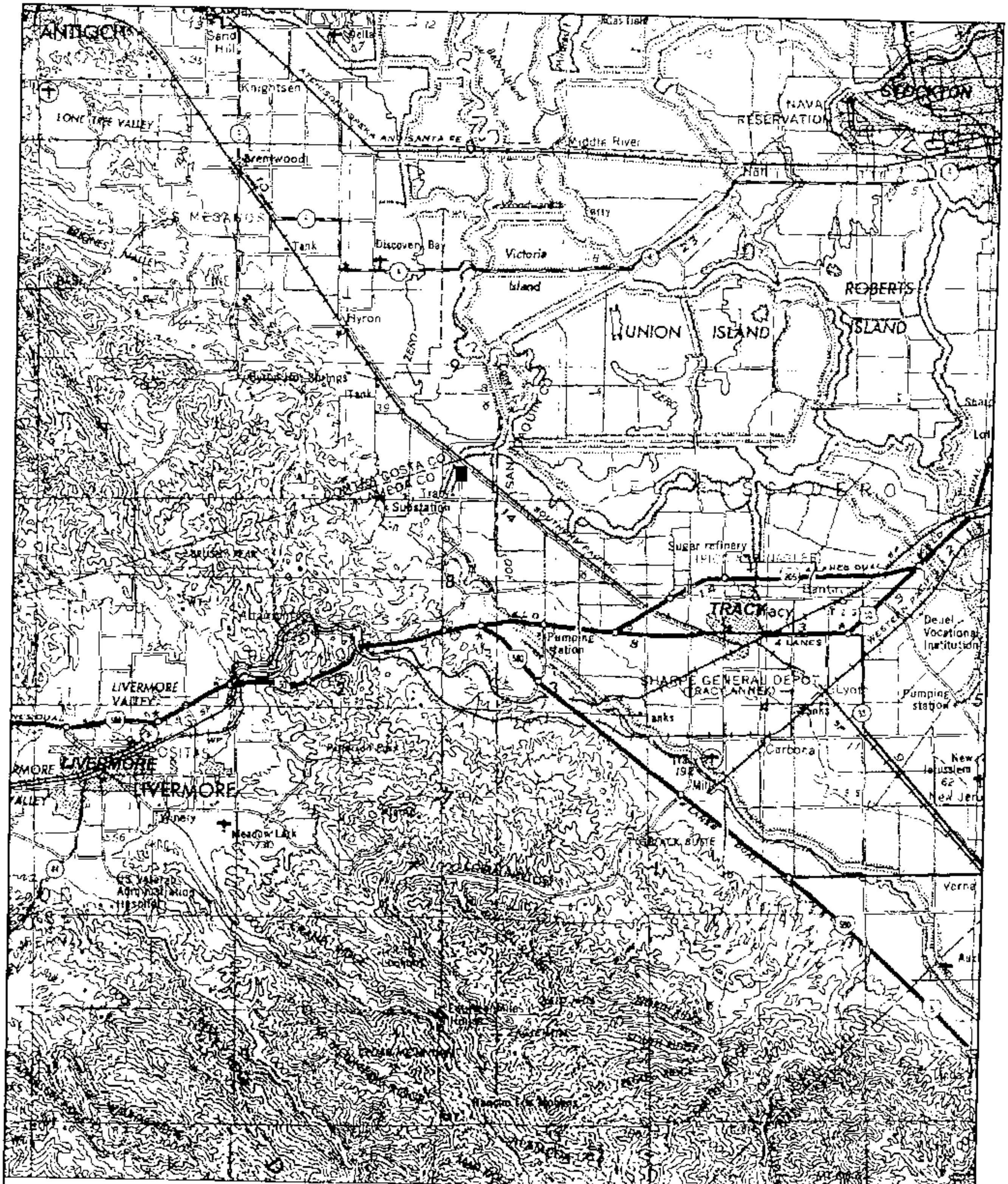
Because the MHCSD WWTP is not yet operational, water quality data were estimated using treated wastewater from Delta Diablo Sanitation District (DDSD), located in Pittsburg, California. While these data were considered reasonably close to what would be expected from the yet-to-be-built MHCSD WWTP, DDSD serves a number of heavy industries that probably contribute a higher load of metals to the wastewater stream than would result from the MHCSD WWTP. In this way, the DDSD data is considered to provide a conservative estimate of the brine quality that would be discharged to on-site evaporation ponds. All constituents shown in Table 1-1 are at concentrations below those that would be classified as hazardous waste, with the exception of chromium and thallium. The applicant believes that these two constituents would not be present in elevated concentrations in the brine discharged at the project because it is unlikely that the total water supply would come from using recycled water only (projected supply is inadequate for this). In addition, these two specific metals are believed direct results of the heavy industrial discharge that exists at DDSD, since the concentrations in the raw water supply are not abnormal. Therefore, the level of constituents in the brine would be between that resulting from either 100 percent raw water or 100 percent recycled water from MHCSD WWTP. In addition, water quality from the MHCSD WWTP is expected to be better (lower concentration of metals) than that from DDSD because there would be no heavy industry served by the MHCSD WWTP. The constituents of the brine are expected to be nonhazardous but at intervals may need to be excavated and removed as solid salt cake. There would be no process wastewater discharge off-site.

TABLE 1-1
Estimated Quality of Brine Discharged to Evaporation Ponds
Under Two Extreme Water Conditions (100 Percent Raw, 100 Percent Recycled)

Constituent/Limits Parameter	Concentrated Brine 100 Percent BBID Raw Water	Concentrated Brine 100 Percent Recycled Water
Cations (mg/L)		
Calcium	4,663	8,294
Magnesium	1,855	1,099
Sodium	40,650	38,166
Potassium	3,451	4,076
Ammonium	22	378
Anions (mg/L)		
Bicarbonate	4,113	1,029
Carbonate	0	0
Hydroxide	0	0
Sulfate	62,911	53,064
Chloride	29,682	38,930
Nitrate	2,199	4,674
Phosphate	0	65
Other (mg/L)		
Total Hardness		
Total Alkalinity		
TSS		
Silica	5,635	2,344
TDS	150,000	150,000
Metals/Misc. (mg/L)		
Fluoride	38	106
Arsenic	1.3	0.4
Barium	9	2
Beryllium	0.38	0.75
Boron	108	149
Cadmium	0.8	0.1

TABLE 1-1
Estimated Quality of Brine Discharged to Evaporation Ponds
Under Two Extreme Water Conditions (100 Percent Raw, 100 Percent Recycled)

Constituent/Limits Parameter	Concentrated Brine 100 Percent BBID Raw Water	Concentrated Brine 100 Percent Recycled Water
Chromium	3.1	6.4
Copper	3.1	0.9
Iron	23	37
Lead	1.8	1.0
Manganese	15	3
Mercury	0.01	0.002
Nickel	3.8	0.8
Silver	1.5	0.1
Selenium	0.0004615	0.07
Thallium	0.38	12.5
Zinc	5	1



LEGEND

PROJECT SITE

N

2 0 2 Miles

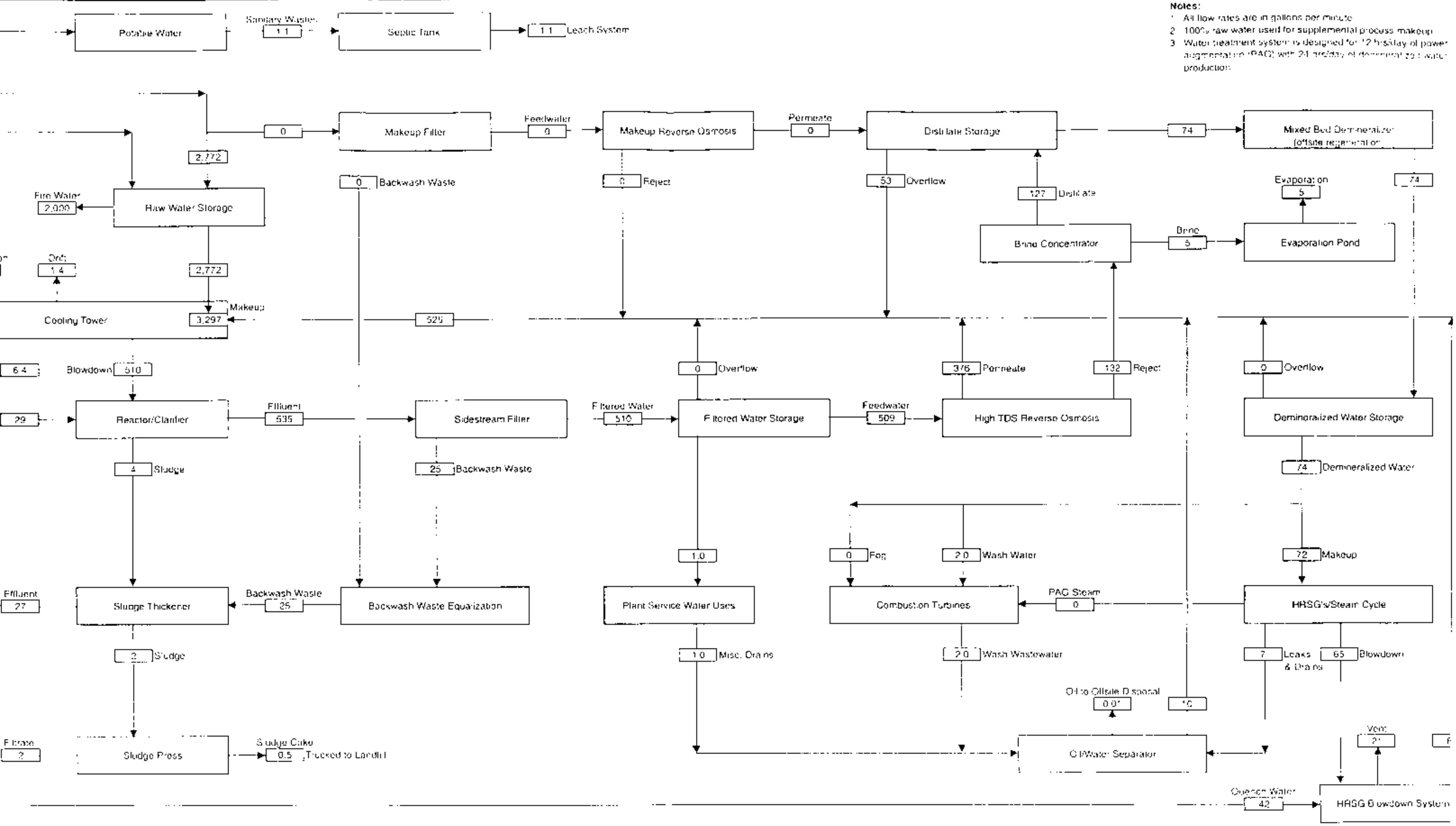
1:250,000

SCALE IS APPROXIMATE

FIGURE 1-1
GENERAL VICINITY MAP

CALPINE EAEC REPORT OF WASTE DISCHARGE

Notes:
1. All flow rates are in gallons per minute
2. 100% raw water used for supplemental process makeup
3. Water treatment system is designed for 12 hrs/day of power augmentation (PAG) with 24 hrs/day of demineralized water production



se: Average Day - 100% Raw Water

s: 3 x 1, HPD Site Altitude: 40 ft

np.: 61 deg F Wet Bulb Temp.: 51 deg. F

No

No

No

ALPINE, Thomas M. Laronge, Inc., 2001

FIGURE 1-2
PLANT WATER BALANCE
AVERAGE DAY-100% RAW WATER

CALPINE EAEC REPORT OF WASTE DISCHARGE

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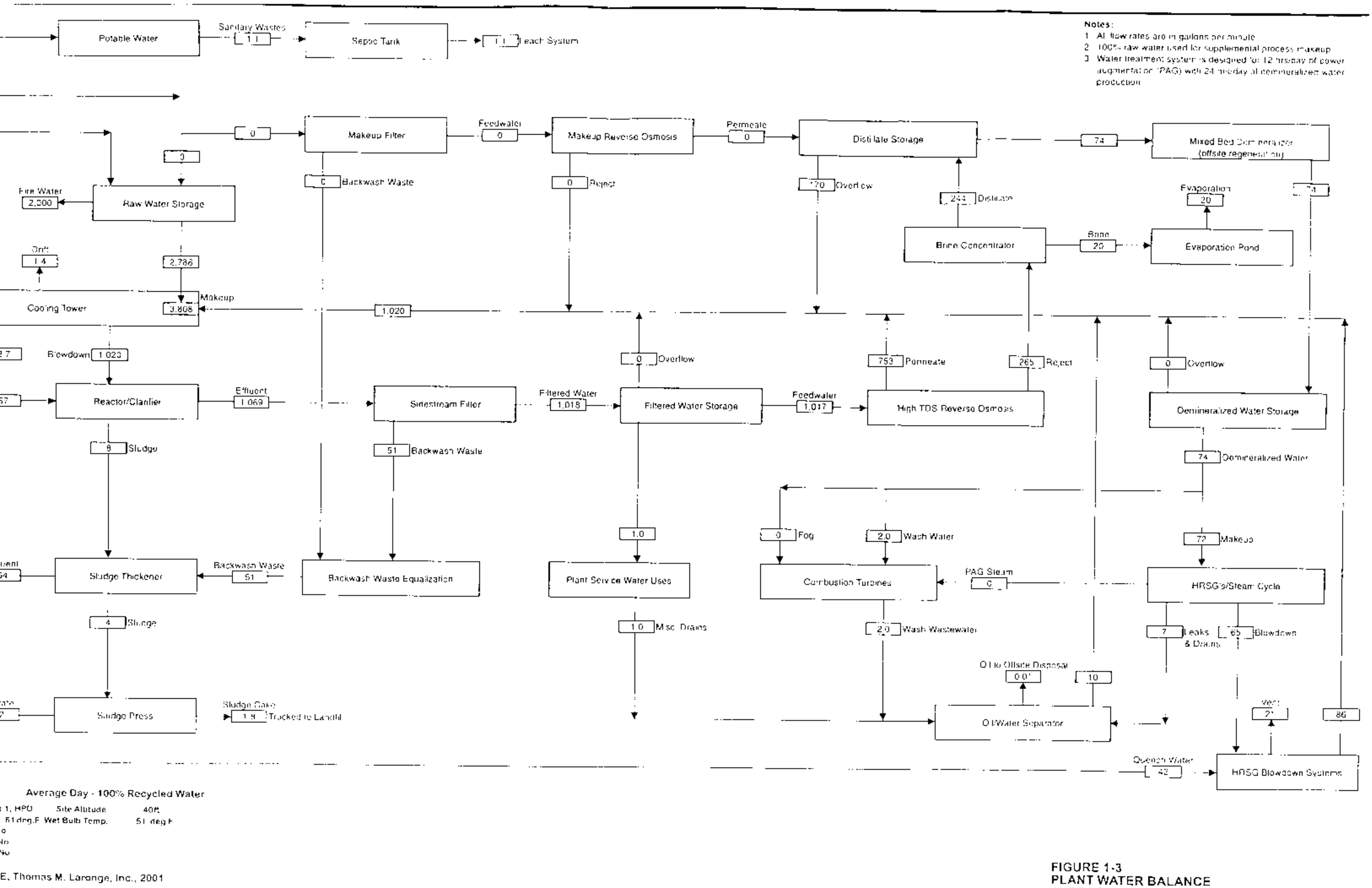

FIGURE 1-3
PLANT WATER BALANCE
AVERAGE DAY-100% RECYCLED WATER

CALPINE EAEC REPORT OF WASTE DISCHARGE

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SECTION 2

Waste Management Unit

2.1 General Description of the Evaporation Ponds

There will be two evaporation ponds and one wastewater recycle pond at the EAEC. Each evaporation pond will have a surface area (bottom) of 5 acres, with a total combined evaporative surface area of 10 acres. Calculations have determined this acreage to be sufficient to evaporate all plant brine flow and direct rainfall into the pond. Appendix A presents an engineering package that includes conceptual design drawings and technical specifications for the two evaporation ponds and wastewater recycle pond. Appendix B presents engineering calculations that determine the pond capacity and depth.

2.2 Pond Design

The inside depth of each pond measured at the interior toe of the pond dikes at the highest edge of the pond bottom, will provide:

- Sufficient depth to provide for normal water level variation throughout the year because of variations in plant inflow, rainfall, and the evaporation rates
- Sufficient depth to provide for the 1,000-year, 24-hour rainfall on top of the maximum water level resulting from water level variations
- A minimum freeboard above the maximum water level equal to 24 inches, which will be sufficient to prevent overtopping of the pond dike as a result of wave run-up during high winds
- Bottom of each pond will be cross-sloped a minimum of 1/2 percent from the toe of each longitudinal dike to the center of the pond

2.3 Pond Dike Design

The ponds will be constructed partially above grade and partially below grade to balance earthwork. Above grade dikes will be constructed of compacted soils obtained from excavations within each cell. Both the interior and exterior dike slopes of each cell will be constructed at a slope not steeper than three horizontal to one vertical. Slope stability was calculated by a geotechnical engineer considering the properties of the subgrade soils and the soils used for dike construction. The seismic acceleration used to define dike slope stability is 0.225 g. The factor of safety against failure shall not be less than 1.5 in a static condition and 1.1 when subject to a seismic occurrence.

The top of the ponds' dikes will be above surrounding grade to prevent stormwater runoff from entering the pond.

The top widths of the dikes will be wide enough to properly anchor the geomembrane lining and provide space for at least a 12-foot-wide aggregate surfaced maintenance road.

2.4 Pond Liner and Leachate Collection and Removal System Design

Each of the three ponds will be lined with a double, synthetic membrane liner system equipped with a Leachate Collection and Removal System (LCRS) installed between the liners. The surface of the liners will be covered with concrete revetment to provide ballast against uplift and mechanical protection for the liners when equipment is driven into the ponds for maintenance or periodic removal of the waste during normal operation and closure activities.

The primary (upper) liner will consist of a textured, 60-mil High-Density Polyethylene (HDPE) geomembrane. A profiled HDPE geonet, with a minimum thickness of 150 mils, covered on both sides with a nonwoven geotextile (for friction enhancement) will be installed below the primary liner. The secondary (lower) liner will be a textured, 60-mil HDPE geomembrane. The secondary liner will be underlain by a nonwoven geotextile to protect the liner from the subgrade soil. The 60-mil-thick HDPE geomembranes will be textured to increase frictional resistance to slippage of cover material and the liner system layers. The revetment, liners, and the geonet will be anchored in an anchor trench at the top of each slope. This design will meet or exceed the 10^{-6} cm/sec liner permeability criteria required under Title 27.

The pond side slopes will be covered with a 4-inch-thick, 8-inch filter point concrete revetment. The filter points extend though the concrete mat and will allow water trapped between the revetment and primary liner to escape when the pond is dewatered to increase stability. The pond bottom will be covered with a 6-inch-thick uniform section concrete revetment. The top of the dikes will be covered with aggregate.

Each pond will be provided with an independent LCRS between the primary and secondary liners that can detect a leak in the inner liner. The HDPE geonet will be installed between the liners to collect leakage through the primary liner and carry it to a drainage trench located in the center bottom of each pond between the liners. The drainage trench will be rock filled and have a minimum of a 6-inch diameter perforated HDPE pipe. Geotextile fabric will be placed around the rock to protect the geomembrane. The bottom of the drainage trench and pipe will be sloped at 1/4 percent toward the leak collection sump located at the end of each pond.

The collection pipe will connect to a non-perforated pipe, penetrate the secondary liner, and enter the collection manhole. The bottom of the sump at the bottom of the manhole will be at least 3 feet below the invert of the collection pipe so that the pipe will not be subjected to static head.

Each leak detection and removal collection sump will be equipped with an installed submersible pump sized to remove the leakage flow from a design leak rate. The pump discharge will be routed to discharge back into the pond.

Each pump will have a locally mounted controller with instrumentation capable of monitoring pump operation and totalizing flow volumes by use of a portable lift station monitor such as a Marsh-McBirney, Inc. Station-Analyzer Model 302 or equivalent. Action Leak Rates will be established for each pond. The LCRS and each pump will be sized to remove twice the maximum leakage resulting from one 100-mm diameter hole per acre with the pond at maximum water level.

The pond influent system will be designed so that each evaporation pond can operate independently should shutdown of a pond for maintenance be required. Discharge into each pond will be via pipes routed over the top of the dikes to avoid penetrating.

Each pond will be provided with a vadose (dry) zone monitoring system consisting of a 60-mil HDPE liner installed beneath the leak collection pipe outside of the ponds and extending to surround the collection manhole. The space between the manhole and the liner will be filled with drainage aggregate. An inspection / pump pipe (4 inches in diameter) will extend vertically to the bottom of the aggregate at a low point in the liner. Any water leakage will flow to the low point at the pipe and be detected. Substantial quantities can be removed by lowering a portable submersible pump into the pipe as required.

2.5 Miscellaneous Design Issues

The entire project, including the ponds, will be surrounded by a perimeter fence to prevent public access to the ponds, to prevent foreign objects from being thrown into the ponds, and to keep animals out of the ponds.

Monofilament lines will be installed over the top of each pond on 8-foot centers to discourage water fowl from landing on the surface of the ponds.

2.6 Quality Assurance

The Preliminary Engineering Package included as Appendix A to this Report of Waste Discharge includes a technical specification on quality control program requirements and a Construction Quality Assurance Plan for the project. Prior to construction, a detailed Field Quality Control Manual will be prepared for testing and inspection of all portions of the installation during construction.

SECTION 3

Topography

The EAEC site is located in the northeasternmost corner of Alameda County. The site lies northeast of the intersection of Mountain House and Kelso roads. The UTM coordinates of the site are 4,185 kilometers northing, 625 kilometers easting. The nominal site elevation is 40 feet above mean sea level.

The project site is located on the western edge of the northern San Joaquin Valley, within the boundary of the San Francisco Bay Area Air Basin. The San Joaquin Valley is quite broad and is generally oriented north to south. The area in the immediate vicinity of the project site, which is located at the eastern edge of the Altamont Hills, is relatively flat toward the east, with terrain rising into the Altamont Hills toward the west.

3.1 Land Use

Land use surrounding the project site can be characterized as rural. Areas within 3 kilometers of the project site are predominantly undeveloped or farmland. Residential development consists primarily of rural, single-family homes along secondary roads. The Tracy Substation and the Delta Mendota Canal and Tracy Pumping Plant are located due west of the site. Figure 3-1, shows the topography surrounding the EAEC project site.

3.2 Floodplain

The project area is protected from flooding by levees and drainage channels to the west and north. FEMA flood zone maps show that the EAEC project site is outside the 100-year flood boundary (Figure 3-2). FEMA-designated 100-year flood plains in the project vicinity occur within 2,000 feet of the south bank of Old River (FEMA, 2000, 1988, 1980).

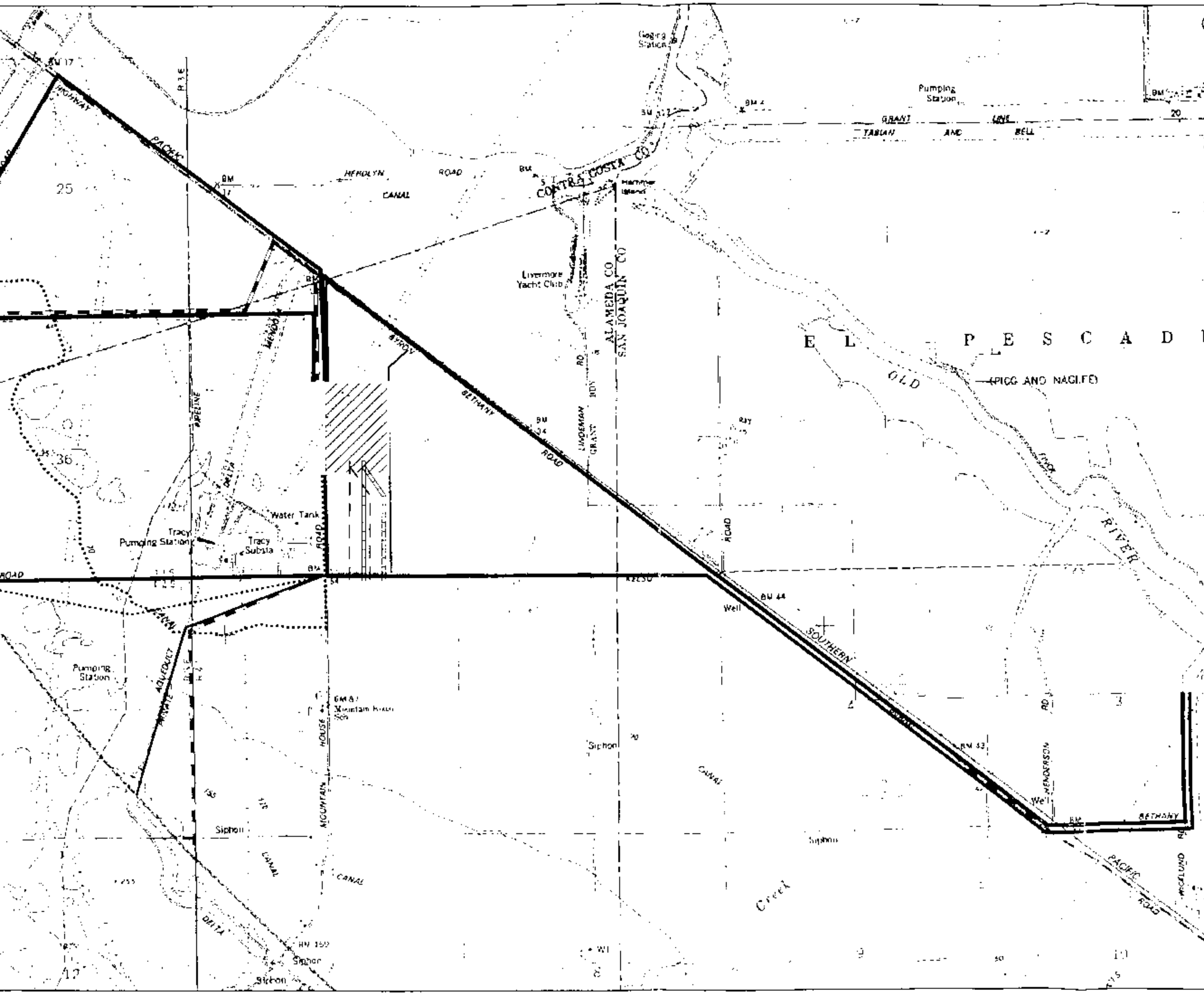

FIGURE 3-1
EAEC SITE AND LINEAR FACILITIES LOCATION MAP

CALPINE EAEC REPORT OF WASTE DISCHARGE

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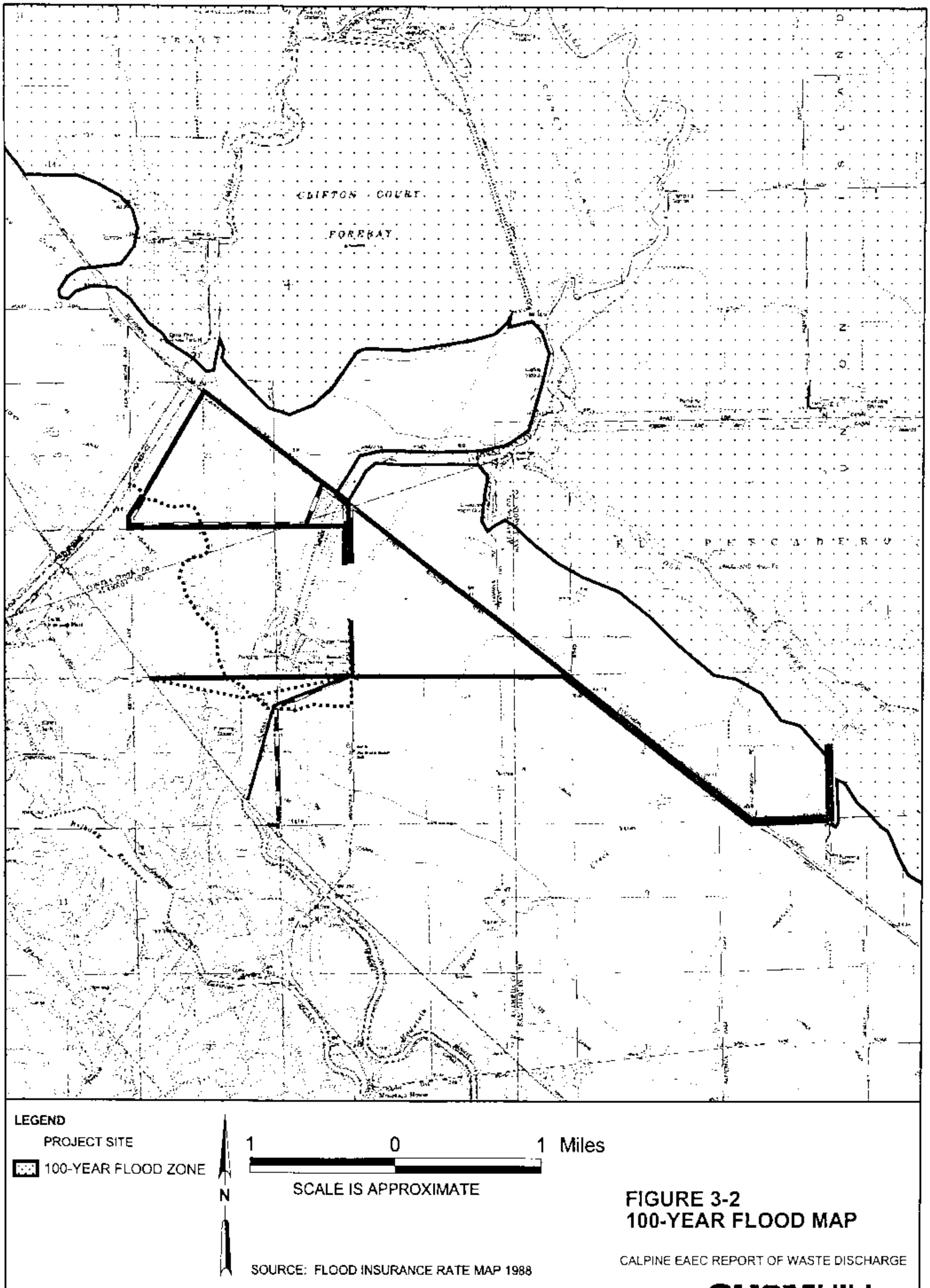


FIGURE 3-2
100-YEAR FLOOD MAP

CALPINE EAEC REPORT OF WASTE DISCHARGE

SECTION 4

Climatology

The climate in the project area is typical of the Central Sacramento Valley with hot, dry summers and mild winters. Daytime temperatures during the summer months range between 80˚F and 100˚F, with peak days reaching 110°F. Total elevation range on the site is from 20 to 60 feet.

The project site is located near the southwestern edge of the Sacramento-San Joaquin River Delta (Delta). This area is characterized by a series of natural and manmade stream channels, canals, and drains that form low-lying islands. The foothills of the Coast Range are approximately 3 miles southwest of the site and define the southwestern edge of groundwater and surface water resources.

4.1 Isohyetal Map

An isohyetal map for the EAEC site (Figure 4-1) is included at the end of this section.

4.2 Precipitation

Most precipitation in the project area falls between November and April. Monthly average rainfall in Tracy, which is similar to that at the project site, is presented in Table 4-1. The total annual average rainfall in the closest city, Tracy, is 10 to 12 inches.

TABLE 4-1
Average Monthly Rainfall Near the Proposed Project Site (Tracy) 1950 – 1998

Precipitation	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Rainfall (in.)	2.38	1.92	1.71	0.80	0.22	0.14	0.05	0.10	0.26	0.67	1.88	1.72	11.85

Reference: Tracy Pumping Plant located one-half mile from EAEC.

4.3 Design Storm

The design storm for this site is based on a 1,000-year, 24-hour event. A storm of this magnitude would produce 3.9 inches of rainfall, according to climatological data collected annually since 1956 (Table 4-2).

TABLE 4-2
Maximum Rainfall for Indicated Number of Consecutive Days (inches)

Est	1	2	3	4	5	6	8	10	15	20	30	60
1956	2.50	2.79	3.06	3.09	3.80	4.07	4.50	4.54	4.90	5.13	6.22	10.46
1957	0.54	0.60	0.90	0.91	1.15	1.36	1.86	1.86	2.22	2.57	2.79	4.44
1958	0.99	1.68	2.30	2.57	2.59	2.71	2.71	2.95	4.35	5.77	6.79	10.16
1959	1.20	1.35	1.45	1.66	1.81	1.81	2.01	2.01	3.05	3.05	3.57	6.06
1960	0.74	0.84	1.14	1.23	1.45	1.61	2.05	2.52	2.52	3.09	3.36	5.45
1961	0.98	1.43	1.45	1.55	2.00	2.00	2.23	2.32	2.40	2.47	2.71	3.02
1962	1.33	1.98	2.40	2.55	3.18	3.48	4.21	4.91	5.86	5.93	6.72	7.16
1963	2.75	2.87	2.87	2.87	2.87	2.87	2.87	2.87	4.12	4.37	4.37	6.19
1964	1.29	1.78	1.78	1.80	2.29	2.29	2.29	2.67	2.67	3.15	3.21	3.89
1965	0.74	1.15	1.35	1.52	2.00	2.20	2.33	2.86	3.61	4.46	4.54	5.69
1966	0.65	1.15	1.45	1.47	2.01	2.25	2.33	2.33	3.14	3.14	3.44	5.37
1967	2.00	2.77	3.00	3.23	3.66	3.89	3.89	5.00	5.26	5.26	5.27	8.20
1968	2.59	2.62	2.67	2.85	2.85	2.85	2.89	2.89	2.89	3.22	3.55	5.52
1969	1.17	1.56	1.84	1.94	2.17	2.17	2.43	3.59	4.05	4.84	6.35	9.13
1970	1.48	1.65	2.04	2.29	2.40	2.40	3.13	3.70	4.77	5.31	5.42	8.23
1971	1.67	2.69	2.73	2.75	3.48	3.50	4.27	4.53	4.73	4.95	6.53	8.16
1972	0.92	0.97	1.18	1.45	1.45	1.52	1.61	1.61	1.88	2.23	3.64	4.09
1973	1.38	1.98	1.98	2.55	3.15	3.56	3.79	3.79	4.13	4.14	5.20	9.65
1974	1.00	1.60	1.60	1.60	1.60	1.79	2.50	2.63	3.24	3.26	3.99	6.30
1975	1.02	1.27	1.29	1.35	1.38	1.42	1.64	2.56	2.98	3.22	3.40	6.44
1976	0.87	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.98	1.62
1977	0.65	0.69	0.70	0.86	1.04	1.04	1.05	1.05	1.17	1.17	1.17	1.60
1978	1.03	1.53	1.86	2.13	2.51	2.51	2.70	2.87	2.87	2.87	3.82	6.51
1979	1.30	1.51	1.51	1.56	2.28	2.28	3.26	3.44	3.53	3.53	3.68	6.66
1980	0.97	1.33	1.79	2.20	2.51	2.90	3.07	3.46	3.46	3.66	5.60	7.15
1981	1.40	1.73	2.28	2.43	2.43	2.43	2.88	2.94	3.03	3.03	3.44	4.40
1982	2.80	4.40	4.40	4.75	4.75	5.83	5.83	5.83	5.84	6.51	6.84	7.55
1983	1.41	1.70	2.39	2.39	2.49	3.52	3.92	4.26	5.12	5.12	7.50	12.74
1984	1.25	1.69	1.87	1.90	2.17	2.17	2.82	3.38	4.72	4.90	5.46	7.81
1985	0.91	1.11	1.16	1.32	1.32	1.91	2.16	2.63	2.82	3.21	4.22	5.97
1986	1.18	2.08	2.45	2.70	3.01	3.46	4.11	4.16	4.71	4.75	8.02	10.60
1987	2.10	3.30	3.49	3.49	3.59	3.59	3.64	3.64	4.15	4.58	4.98	6.63
1988	1.13	1.13	1.33	1.33	1.33	1.38	1.38	1.49	2.24	2.95	3.09	4.56
1989	0.79	0.79	0.83	0.83	0.93	1.00	1.10	1.42	1.56	1.76	1.86	2.88
1990	1.33	1.63	1.63	1.69	1.69	1.96	2.00	2.00	2.00	2.13	2.13	3.17
1991	1.16	1.16	1.51	1.51	1.51	1.51	1.51	1.51	2.08	2.38	3.60	5.58

TABLE 4-2
Maximum Rainfall for Indicated Number of Consecutive Days (inches)

Est	1	2	3	4	5	6	8	10	15	20	30	60
1992	1.01	1.14	1.20	1.71	2.66	2.80	2.90	3.18	3.60	3.63	3.99	5.45
1993	1.50	1.76	1.92	2.22	*2.29*	*2.36*	2.66	*3.66*	4.70	5.18	6.17	10.28
1994	0.88	1.01	1.20	1.20	1.26	1.30	1.35	1.35	2.46	2.55	3.57	3.73
1995	1.28	1.51	1.63	1.68	1.78	2.13	2.29	2.51	3.47	3.69	5.19	5.80
1996	1.28	2.42	2.81	3.13	3.44	3.44	3.73	3.91	4.40	4.67	5.32	9.99
1997	1.48	1.75	1.80	1.88	2.14	2.43	2.51	2.53	3.03	3.35	5.44	8.80
1998	1.40	1.99	2.42	2.54	2.97	3.29	4.07	4.57	5.63	6.49	8.10	11.84
1999	0.76	1.26	1.83	1.94	1.95	2.03	2.13	2.51	2.86	3.05	4.58	5.85
Average	1.29	1.69	1.90	2.03	2.28	2.45	2.72	2.98	3.48	3.76	4.54	6.61
Std Dev	.55	.75	.77	.80	.87	.98	1.06	1.13	1.24	1.34	1.71	2.63
Rec Max	2.80	4.40	4.40	4.75	4.75	5.83	5.83	5.83	5.86	6.51	8.10	12.74
Yrs Rec	44	44	44	44	44	44	44	44	44	44	44	44
Z	3.30	4.21	3.26	3.33	2.78	3.53	2.96	2.50	1.79	1.90	2.07	2.46
CV	.423	.447	.404	.395	.381	.400	.389	.379	.358	.357	.377	.398
Reg CV	.354	.382	.406	.401	.391	.390	.388	.382	.383	.385	.378	.377
Reg Skew	1.1	1.1	1.1	1.0	0.8	0.8	0.8	0.8	0.6	0.8	0.7	0.7
FIC	1.14	1.07	1.04	1.02	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00
RP 2	1.38	1.68	1.83	1.94	2.18	2.33	2.58	2.83	3.35	3.57	4.34	6.32
RP 5	1.86	2.32	2.57	2.71	3.00	3.20	3.54	3.87	4.54	4.89	5.90	8.58
RP 10	2.17	2.73	3.04	3.19	3.50	3.73	4.12	4.51	5.25	5.70	6.83	9.93
RP 25	2.55	3.23	3.62	3.77	4.09	4.36	4.82	5.26	6.06	6.65	7.92	11.51
RP 50	2.82	3.59	4.04	4.19	4.51	4.80	5.30	5.78	6.62	7.32	8.67	12.61
RP 100	3.08	3.93	4.44	4.59	4.90	5.22	5.76	6.28	7.15	7.95	9.39	13.64
RP 200	3.33	4.27	4.83	4.98	5.28	5.62	6.21	6.76	7.65	8.56	10.07	14.64
RP 500	3.67	4.71	5.35	5.45	5.80	6.17	6.81	7.42	8.32	9.40	10.99	15.97
RP 1000	**3.91**	5.03	5.71	5.85	6.12	6.51	7.19	7.82	8.75	9.91	11.58	16.82
RP 10000	4.69	6.07	6.92	7.03	7.25	7.71	8.51	9.26	10.21	11.74	13.59	19.75

Reference: Tracy Pumping Plant, located approximately one-half mile southwest of the site. Department of Water Resources.

4.4 Evapotranspiration

Evaporation data at the Tracy Pumping Plant have been collected since 1955. Based on that data, average pan evaporation rates for the project are as shown in Table 4-3.

TABLE 4-3

Average Pan Evaporation Rate at Tracy Pumping Plant (inches)

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1.35	2.54	5.22	8.12	11.93	14.69	17.18	14.58	10.28	6.57	2.89	1.34	96.69

Reference: Tracy Pumping Plant, located one-half mile from EAEC. Department of Water Resources.

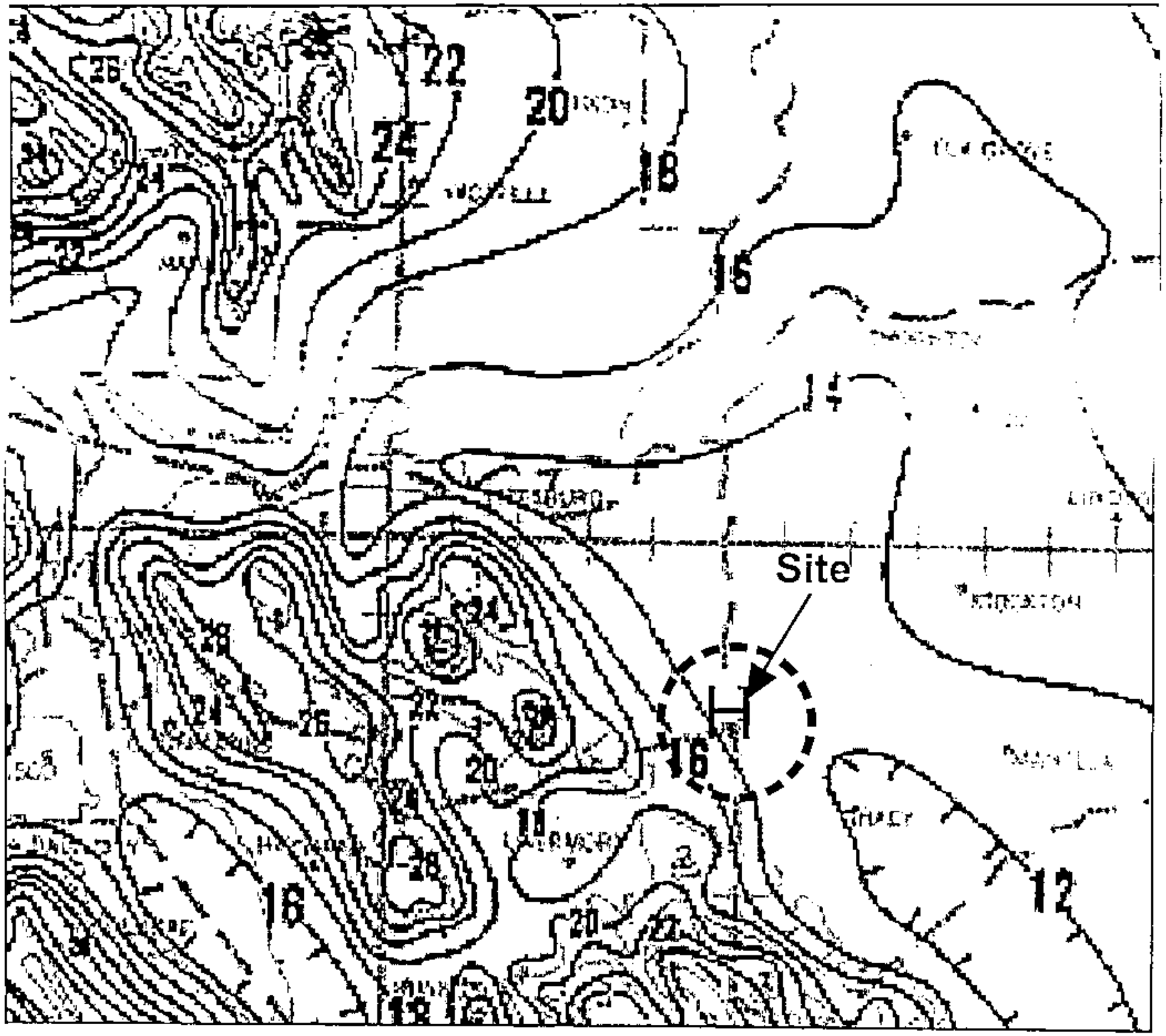
The minimum monthly evaporation on record was 0.61 inch, which occurred in January 1961. The maximum monthly evaporation on record was 46.48 inches, which occurred in July 1981.

4.5 Runoff Volume/Pattern

The evaporation ponds will be constructed with berms to prevent any run-on or run-off. The maximum probable design storm (1,000-year, 24-hour storm) is estimated to generate 3.91 inches of precipitation. The pond berms will be constructed to accommodate this volume plus sufficient freeboard to comply with Title 27. Please refer to Section 2 describing the pond design and Appendix A, which shows site drainage patterns on the site plan.

4.6 Wind Rose

Air flow in the valley can be characterized by up-valley and down-valley winds. The down-valley winds are generally caused by airflows into the valley from the Carquinez Strait and the Altamont Pass that then flow south. However, the local climate of the project area is modified by the Altamont Hills. Strong diurnal wind regimes markedly affect the horizontal transport of air in the project area. This results in a pronounced west-southwest component to the wind rose, which is presented on Figures 4-2 through 4-4 (included at the end of this section). This wind rose is from an existing air quality monitoring station, which collects hourly wind speed, wind direction, and temperature data, located northwest of the town of Tracy and operated by the San Joaquin Valley Unified Air Pollution Control District. The annual wind rose shows a consistent high-speed wind pattern (58 percent of wind speeds are greater than 3.7 meters per second), with predominant wind direction of west-southwest and a secondary maximum at west. Analysis of a stability rose of this station demonstrates that D Stability occurs up to 38 percent of the time, with the predominance of D Stability primarily because of the frequency of high wind-speeds. In general, this flow is indicative of the influence of the Altamont Pass.



References

National Weather Service
NOAA Atlas 2, Volume X

Legend:

Isopluvial contours shown for 10-yr, 24-hr storm in tenths of an inch.

FIGURE 4-1
Isohyetal Map

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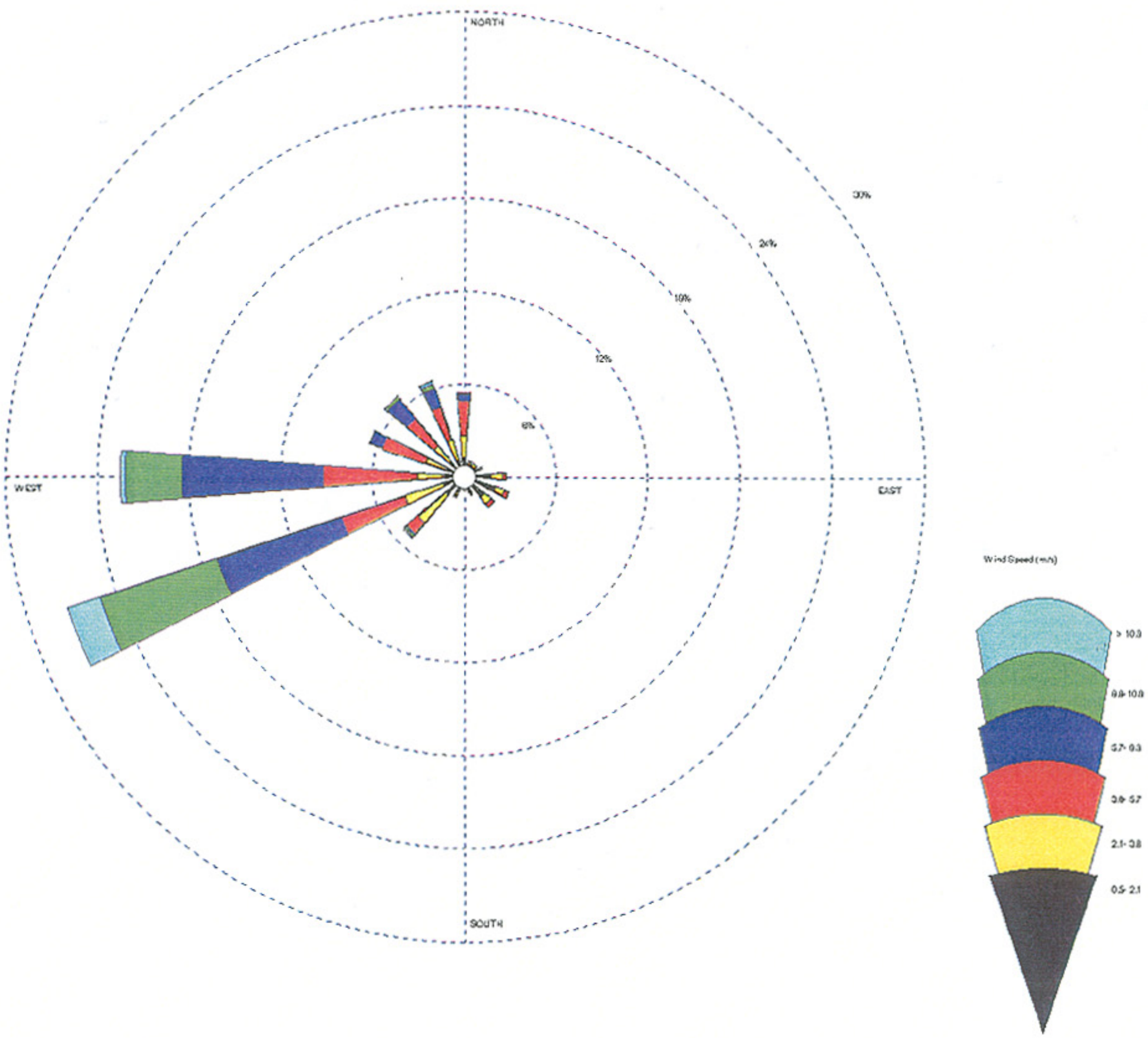


FIGURE 4-2
Wind Rose for Tracy Monitoring Station
(January 1, 1997 through December 31, 1997)
CALPINE EAEC REPORT OF WASTE DISCHARGE

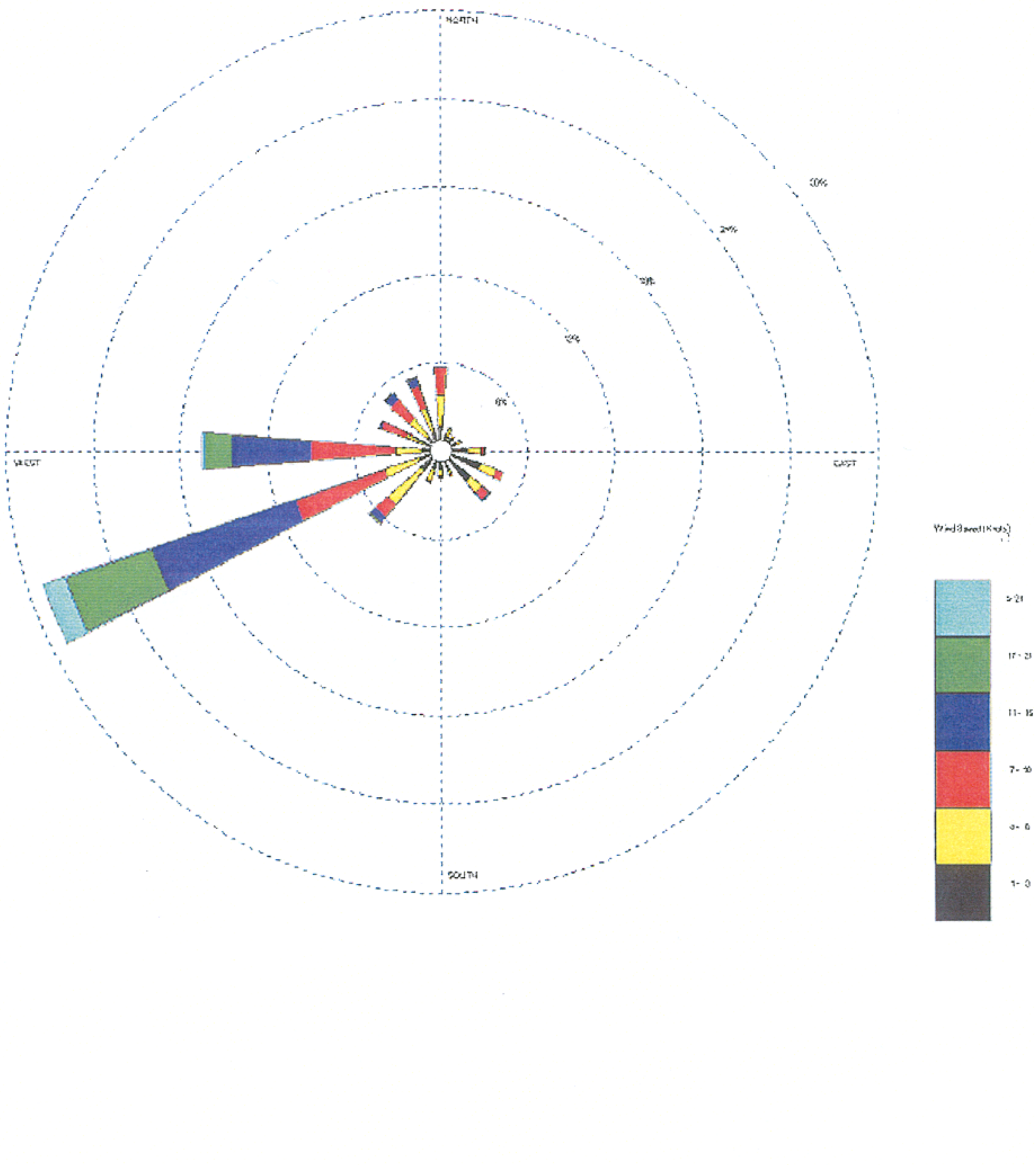


FIGURE 4-3
Wind Rose for Tracy Monitoring Station
(January 1, 1998 through December 31, 1998)
CALPINE EAEC REPORT OF WASTE DISCHARGE

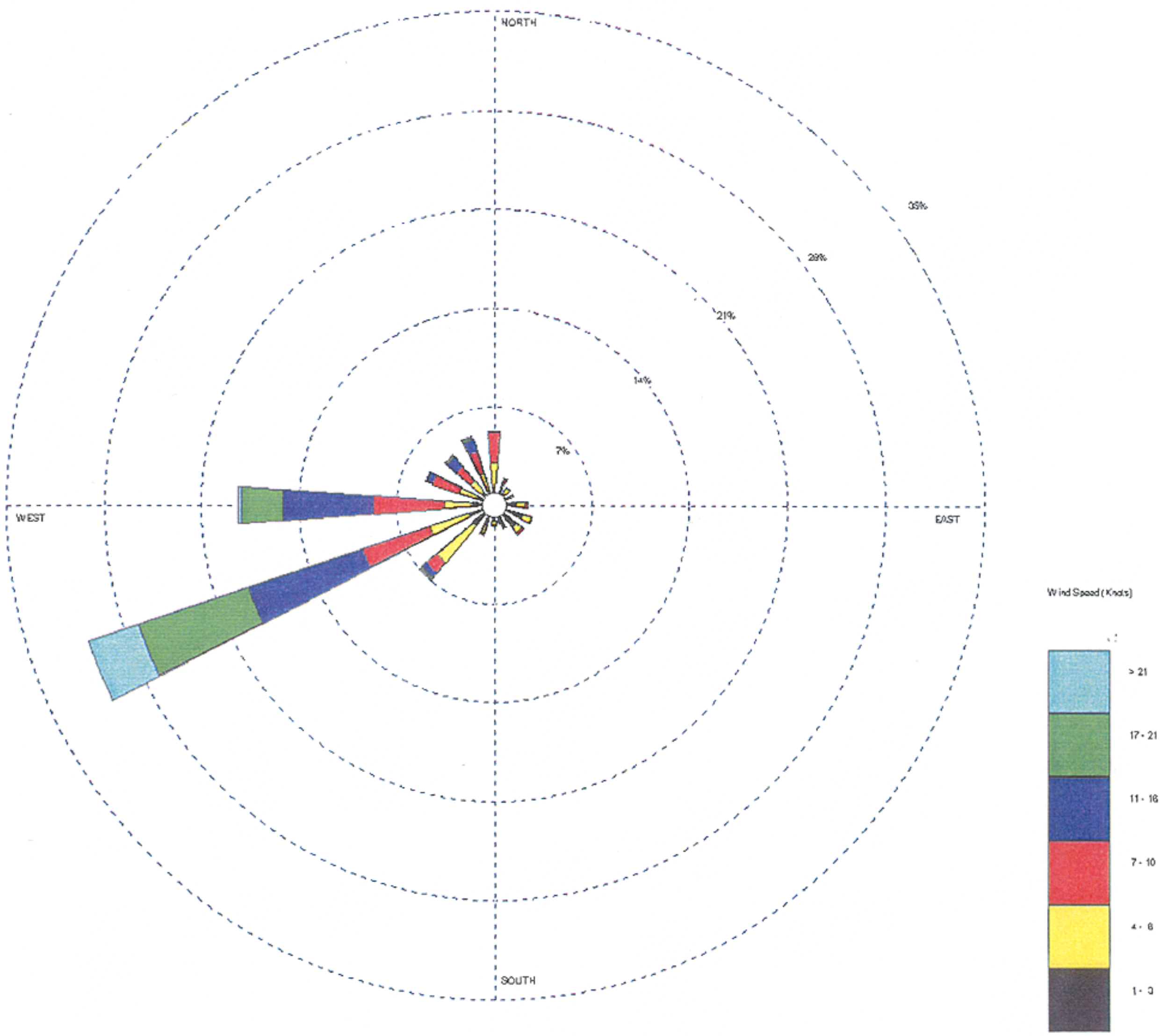


FIGURE 4-4
Wind Rose for Tracy Monitoring Station (January 1, 1999 through December 31, 1999)
CALPINE EAEC REPORT OF WASTE DISCHARGE

SECTION 5

Geology

The EAEC site is located near the border of the Coast Range and the Great Valley geomorphic provinces. The Coast Range is a series of valleys and mountains along the West Coast of California that extend from Oregon to the Santa Ynez River near Santa Barbara. The Great Valley is a 400-mile-long, northwest-southeast trending structural basin that extends along the center of the state from the Klamath Range in the north to the Tehachapi Mountains in the south. The proposed generating facility site is relatively flat and is underlain by Quaternary alluvial deposits.

5.1 Maps and Cross-Sections

Figure 5-1 shows the general hydrogeologic features in the vicinity of the EAEC. The area is characterized by a series of alluvial fans deposited off the Coast Range onto the Valley flood basin deposits. Figure 5-2 shows two cross-sections developed from the on-site geotechnical borings and an existing off-site well located near the Mountain House School. Cross-section A-A' generally shows the distant areas of the Mountain House Fan, upon which the EAEC site is located.

The soils at the site and its immediate vicinity are Rincon Clay Loam, zero to 3 percent slopes. This well-drained soil is formed in alluvium from sandstone and shale on nearly level valley bottoms and fans. The soil has a slowly permeable subsoil. Runoff is slow and available water-holding capacity is high. Water erosion hazard is slight. Shrink-swell potential is moderate to high. This soil is somewhat difficult to work with and used commonly for irrigated alfalfa and pasture.

5.2 Materials

The area underlying the EAEC site consists of the Rincon clay loan soils and the clays, silts, and discontinuous sand intervals. This is seen not only in the cross-sections shown in Figure 5-1, but also in each of the three 20-foot borings drilled where the evaporation ponds and the stormwater detention basin will be located (borings B-44 and B-45, included in Appendix C). Only silty clay, silty clay with sand, or sandy clay classified as CL in the Unified Soil Classification System were logged by Kleinfelder at each of the 20-foot borings drilled within the proposed evaporation ponds. No sand was logged in either boring.

Groundwater was encountered at approximately 11 to 12.5 feet below grade in each of the borings.

5.3 Geologic Structure

The structural geology of the area is dominated by deformation in the coast ranges associated with historical tectonic activity, the faulting in the coast range (discussed below), and the alluvial fan deposition off the coast range. Bedrock is estimated to occur between 600 and 800 feet below ground level. Other than the occurrence of the alluvial fans, there are no other known geologic structures at the site.

Several major geologic units occur in the vicinity of the EAEC site. These are discussed in Table 5-1.

TABLE 5-1
Geologic Units in the Vicinity of the EAEC

Unit Name	Period of Deposition	Type of Deposition	Characteristic Sediments
Dos Palos Alluvium	Holocene	flood basin	flood plain deposits from Holocene age
Alluvial fans	Holocene	alluvial fans	unconsolidated variable thicknesses of gravel, sand, silt, and clay
Tulare Formation	Pliocene to Pleistocene	valley fill	semi-consolidated to consolidated clay, silt, sand, and gravel
Fanglomerate deposits	Miocene	alluvial fans	conglomerate, sandstone, and siltstone
San Pablo Group	Miocene	marine	sandstone, mudstone, siltstone, shale, and minor tuff
Panoche Formation	Cretaceous	marine	sandstone, shale, siltstone, and conglomerate lenses
Moreno Formation	Cretaceous	marine	organic shale, siltstone, and sandstone
Franciscan Complex	Jurassic	mélange	sandstone, shale, chert, greenstone, and serpentinite

Geologic Map of the San Francisco-San Jose Quadrangle (D.L. Wagner et al., 1990)

Some landslides have occurred in the coast range (Dibblee, 1972), which is located 1 mile south of site. These slides are localized, however, and have not been mapped in the vicinity of the EAEC site.

5.4 Engineering and Chemical Properties

The engineering and chemical properties of the geologic materials underlying and surrounding the site are described in Section 5.2: Materials, and Section 5.5: Stability Analysis. The engineering and chemical properties of the liner system, LCRS, and other components are described in Section 2. Section 1.4 presents the estimation of the engineering and chemical properties of the waste stream.

5.5 Stability Analysis

This section presents a summary of slope stability analyses performed for the evaporation and wastewater recycle ponds at the EAEC. This analysis is based on the results of 46 borings and Cone Penetrometer Test (CPT) soundings and 11 backhoe test pits within the project site. Field explorations suggest a relatively uniform soil profile in the upper approximate 15 feet that would be affected by the pond construction. Atterberg limits tests performed at depths of

1, 5, and 10 feet indicate plasticity indices of 20, 28, and 20, respectively. As a result of the field tests, this analysis assures a single-soil profile of silty clay / clayey silt. The results of several CPT soundings from near the pond locations (B-34, B-35, B-38, and B-40) indicate undrained shear strength in excess of 1,000 pounds per square foot (psf) are included in Appendix D. Included in Appendix D are the results of unconfined compressive strength tests on samples from the 3- to 15-foot depths that also indicated shear strengths in excess of 1,000 psf.

The static and pseudo-static slope stability of the embankment was analyzed using simplified circular arc limit equilibrium procedures and the computer program Slope W by GEO-SLOPE International. This program can model circular arch failures surface in accordance with Spencer, Bishop, and Morganstern-Price methods and Corps of Engineers criteria. The stability evaluation methods first assume a trial circular failure surface through the embankment. The soil mass located above the failure surface is then divided into a series of vertical slices for ease of analysis, and resisting and driving forces acting on each slice are determined. These forces include the soil weight, the pore pressure, the effective normal force on the base, the mobilized shear force (including both cohesion and friction), and the horizontal side forces caused by earth pressures. The stability of the embankment along the trial failure surface is estimated based on the factor of safety or ratio of moment resisting forces (soil strength, etc.) to moment driving forces (soil weight, pore pressures, etc.). The analysis is continued by assuming various trial failure surfaces until a minimum factor of safety or critical failure surface is determined.

For evaluation of end of construction conditions, it was assumed the ponds would be empty. Since the ponds will be occasionally emptied for maintenance, the most severe, long-term loading condition would also be with no water. In other words, the placement of water in the ponds for long-term analyses would only increase the computed factors of safety since the weight of water would resist overturning forces. Any additional support provided by the 4- to 8-inch thick concrete mat on the bottom and side slopes has been neglected. It has been assumed that material excavated from the pond area would be used to raise the grade around the evaporation and wastewater recycle ponds. For the purpose of these analyses, it has been assumed that the ground surface would be raised approximately 5 feet surrounding the ponds, which would place groundwater more than 5 feet below the bottom of the ponds. In Kleinfelder’s opinion, groundwater at this depth would have insignificant impact on the stability analyses. As mentioned above, the soil parameters used in the analyses were based on our evaluation of the material type and density, laboratory index properties, and results of laboratory strength tests. The consistency or relative densities of the soils were also based on field penetration tests. An average moist unit weight of 125 pounds per cubic foot (pcf) was used for the native clay soil. An undrained shear strength of 1,000 psf was used for the end of construction conditions. For long-term stability, an angle of internal friction of 20º F was added to the soil profile and the undrained strength reduced to a very conservative value of 200 psf.

The results of earthquake analyses are critically dependent on the value of the horizontal seismic coefficients. The vertical seismic coefficient typically has little influence on the determined embankment factor of safety and was thus neglected. In recognition that the embankment is not rigid, and that the peak acceleration exists for only a short time, Marcuson (1981) suggested that appropriate horizontal seismic coefficients for levees and dams should correspond to one-third to one-half of the maximum acceleration, including amplification or deamplification effects to which the embankment is subjected. Similarly, Hynes and Franklin (1984) applied the Newmark sliding block analysis to over 360 accelerograms and concluded that earth dams with pseudo-static factors of safety greater than 1.0 using a horizontal seismic coefficient of one-half the maximum acceleration and a 20 percent reduction in shear strength would not develop “dangerously large” deformations. Accordingly, for the purpose of our analysis, a horizontal seismic coefficient of 0.225, corresponding to one-half the peak ground acceleration determined by the Calfed Bay-Delta Program report (1998), was selected. The shear strength data was not reduced by 20 percent, since the values selected already are considered very conservative.

The graphical results of this stability analysis for each condition are included in Appendix D. These graphical results show the geometry of the critical slope and supporting calculation data. A review of the analyses shows that the proposed embankment should be very stable under all conditions with factors of safety exceeding 1.48 for seismic conditions and 2.8 for static conditions. This analysis is based on assuming an expected peak ground acceleration of 0.45 g and a maximum credible earthquake (MCE) of magnitude 7.0.

5.6 Fault Identification and Proximity

Table 5-2 lists active (Holocene) and inferred faults within approximately 30 miles of the site. An estimate of the MCE for each fault is listed based on California seismic hazard mapping (Mualchin, 1996) and the Working Group on Northern California Earthquake Potential (WGNCEP, 1996).

TABLE 5-2
Major Faults Within 30 Miles of the East Altamont Energy Center

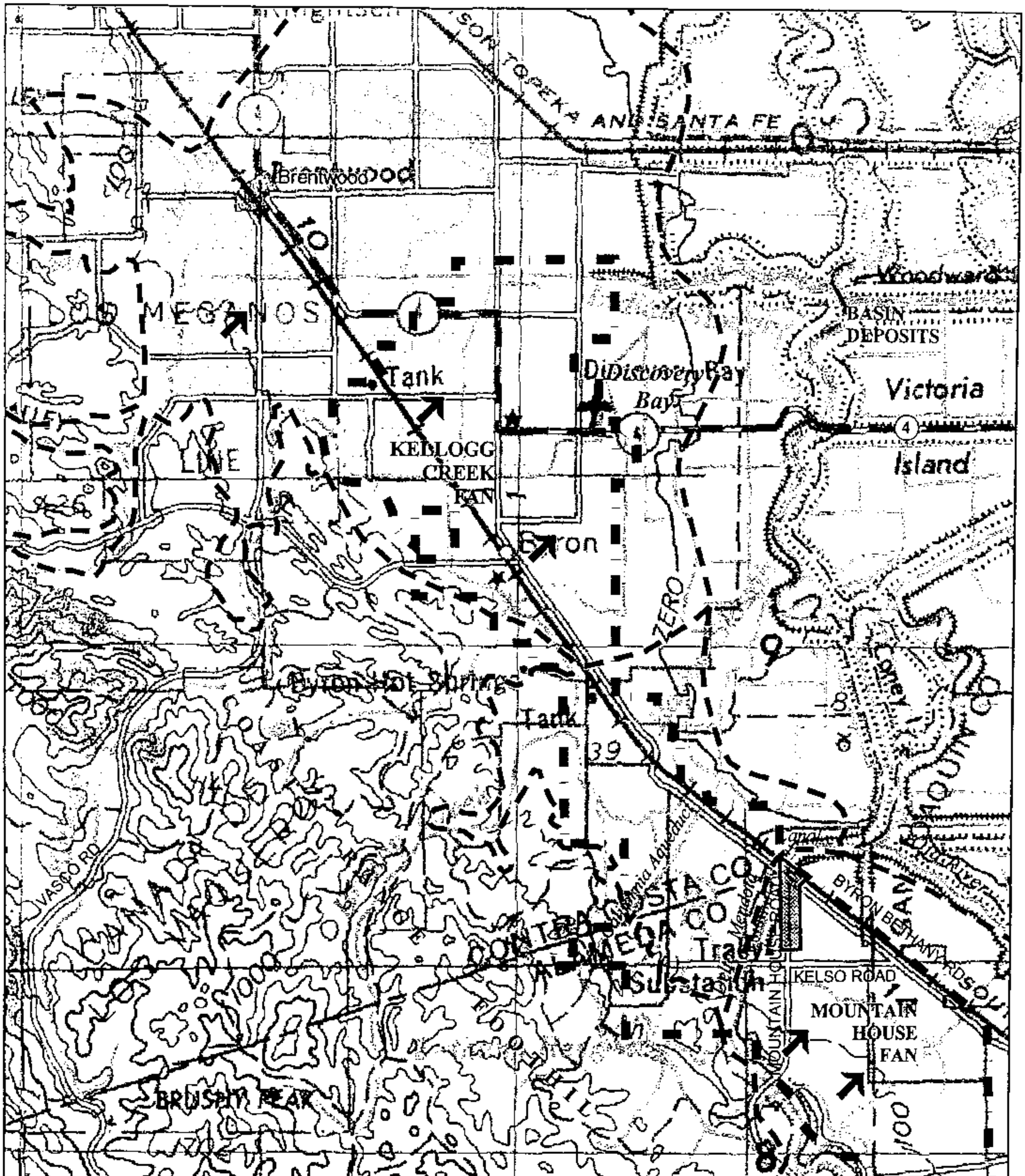
Fault Name	Fault Length (miles)	Horizontal Distance and Compass Direction from EAEC Site to Fault Trace (miles)	Maximum Credible Earthquake (MCE) M_W
Calaveras	75	21-W	7.5
Coast Ranges Sierran Block	370	4-SW	7.0
Concord	12	24-NW	6.5
Greenville	45	9-SW	7.25
Hayward	62	27-W	7.5
Midland	12	6-N	Unknown
Midway-San Joaquin	45	3.5-SW	6.75
Pleasanton	3	19-SW	Unknown
Southampton	9	28-NW	6.25
Tracy (Stockton)	30	6-SE	Unknown
Vernallis	17	5-E	7.5
Verona	5	18-SW	6.0

See report text for data sources.

5.6.1 Historical Seismicity

Recent historical seismicity for the San Francisco Bay region is associated with the San Andreas, Hayward, Calaveras, and Greenville faults. Early settlers wrote the earliest records of earthquakes in this region in the 1800s. The Northern California Earthquake Data Center has compiled data for 7,940 earthquakes. There have been approximately 12 recorded earthquakes of M_L 6.0 or greater in the San Francisco Bay region in recent history. Ground-shaking hazards are significant for earthquakes of this magnitude. The most recent seismic events in the vicinity of the site include the 1979 Coyote Lake earthquake, the 1984 Morgan Hill earthquake, and the 1989 Loma Prieta earthquake.

Figure 5-4 shows the principal faults in the region. Fault data have been obtained from The Geologic Map of the San Francisco–San Jose Quadrangle, California (1:250,000 scale) compiled by Jennings (1994), Mualchin (1996), Bortugno et al. (1991), Northern California Earthquake Data Center (1998), and Campbell et al. (1995). There are no known Holocene faults within 200 feet of the facility.



LEGEND

- EAEC Site
- BBID Boundary
- Approximate extent of groundwater occurrence in fan deposits (Clair Hill & Assoc. 1964)
- Approximate direction of groundwater gradient

N

1 0 1 Miles

SCALE IS APPROXIMATE

FIGURE 5-1
LOCAL HYDROGEOLOGIC FEATURES

Source: Application for Certification to CEC

CALPINE EAEC REPORT OF WASTE DISCHARGE

CH2MHILL

E062001006SAC

SAC-E 161327.LS.10 Figure5_1.fh9 06/08/01 dfacile

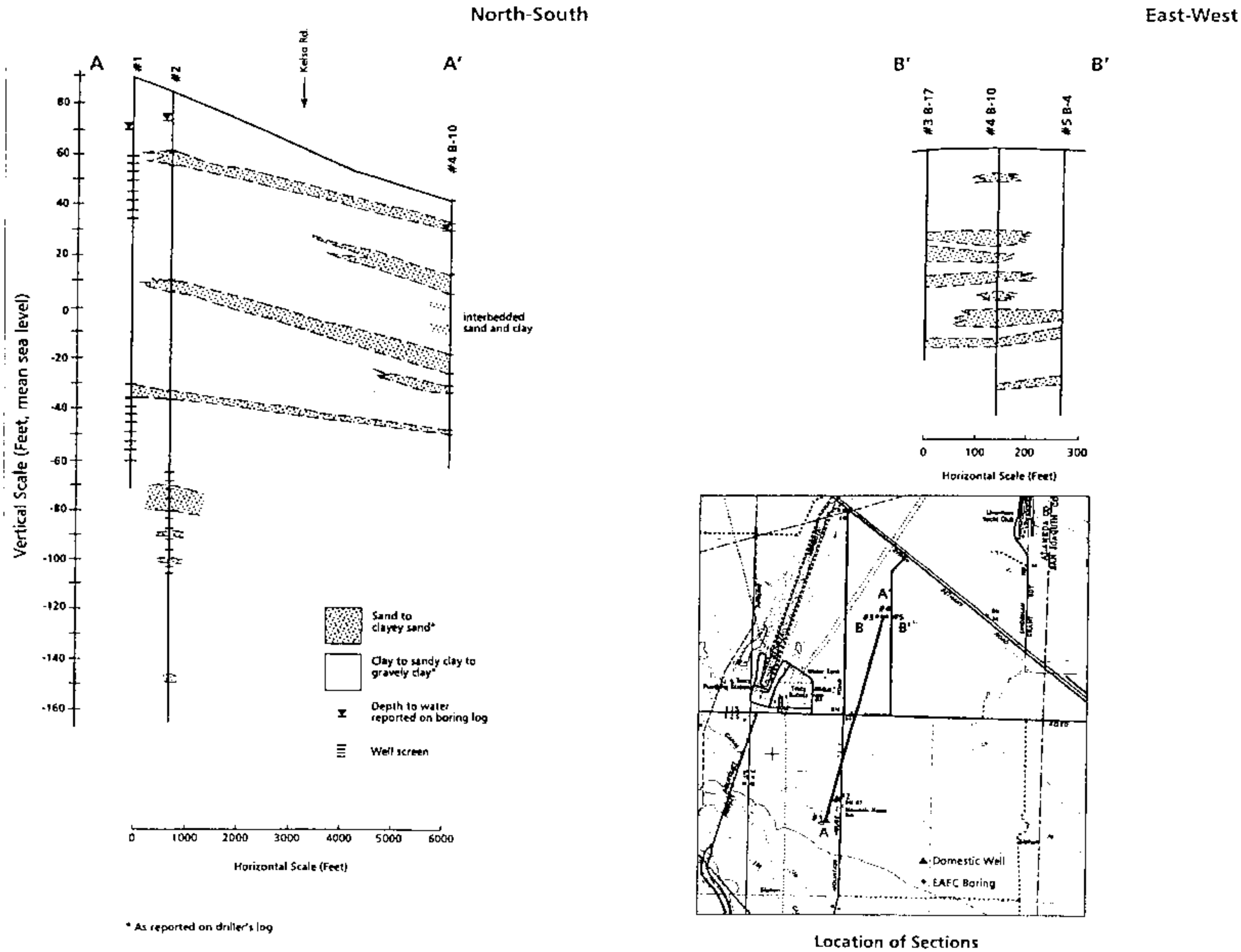
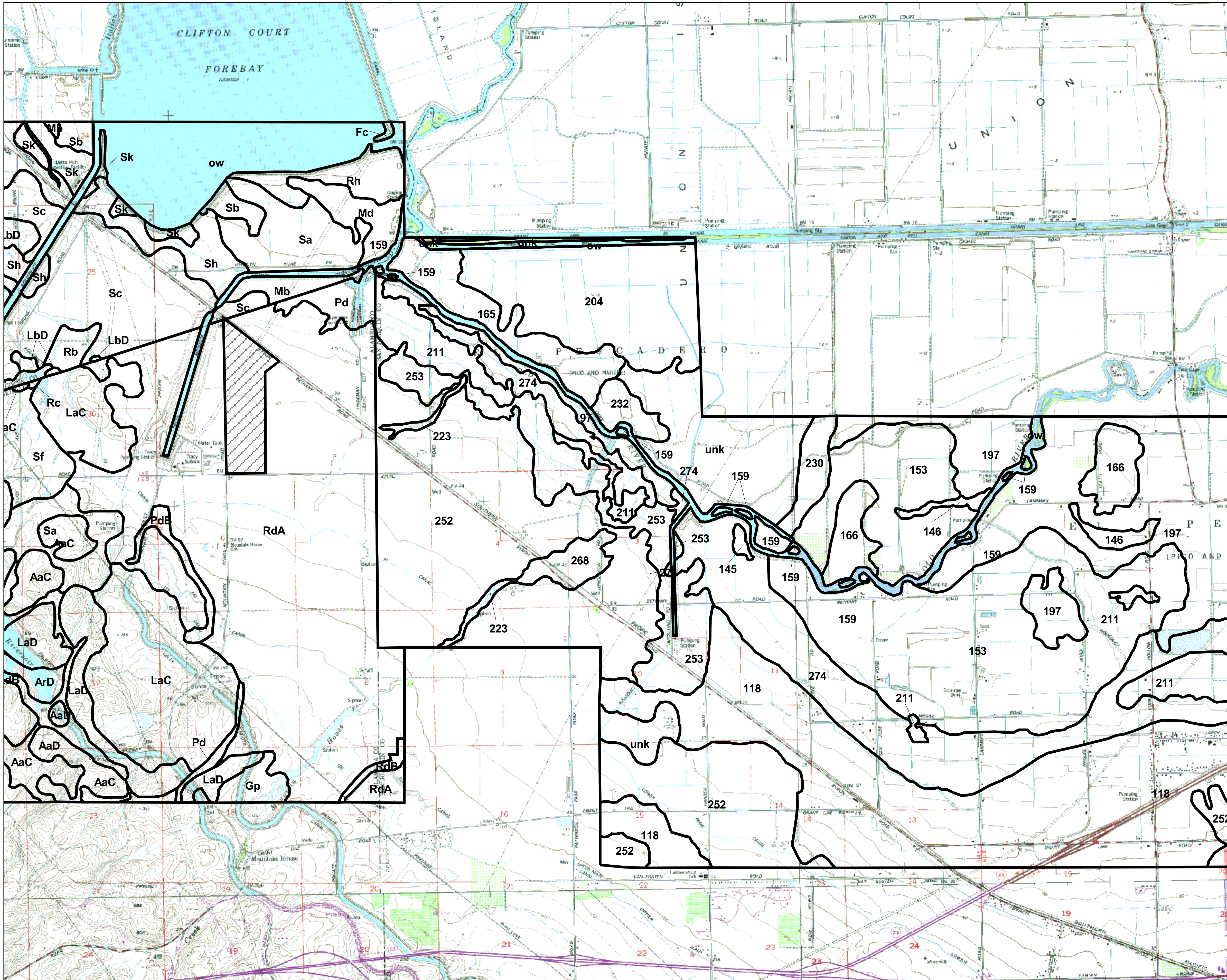


FIGURE 5-2
Hydrogeological Cross-Section

Source: Application for Certification to CEC

CALPINE EAEC REPORT OF WASTE DISCHARGE



LEGEND

ALAMEDA COUNTY
AaC ALTAMONT CLAY
Fc FLUVAQUENTS
Gp GRAVEL PIT
La LINNE CLAY LOAM
Md MERRITT LOAM, NEARLY LEVEL
Pd PIPER SAND, 0-2% SLOPES
Rb RINCON CLAY LOAM
Rc RINCON LOAM
Rd RINCON CLAY LOAM
RdA RINCON CLAY LOAM, 0-3% SLOPES
RdB RINCON CLAY LOAM, 3-7% SLOPES
Rh RIVERWASH
Sa SAN YSIDRO LOAM
Sb SACRAMENTO CLAY, ALKALI
Sf SOLANO FINE SANDY LOAM
Sk SOLANO LOAM, STRONGLY ALKALI

CONTRA COSTA COUNTY
Bb BRENTWOOD CLAY LOAM
Lb LINNE CLAY LOAM
Mb MARCUSE CLAY
Sa SACRAMENTO CLAY
Sc SAN YSIDRO LAOM
Sh SOLANO LOAM

LEGEND

SAN JOAQUIN COUNTY
118 CAPAY CLAY
145 DELLO LOAMY SAND, DRAINED 0-2% SLOPES
146 DELLO LOAMY SAND, PARTIALLY DRAINED 0-2% SLOPES
153 EGBERT SILTY CLAY LOAM
155 GRANGEVILLE FINE SANDY LOAM
159 FLUVAQUENTS 0-2% SLOPES, FREQUENTLY FLOODED
165 GONZAGA-HONKER-FRANCISCAN COMPLEX, 50-75% SLOPES
166 GRANGEVILLE FINE SANDY LOAM, PARTIALLY DRAINED, 0-2% SLOPES
197 MERRITT SILTY CLAY LOAM PARTIALLY DRAINED
204 PELTIER MUCKY CLAY LOAM, PARTIALLY DRAINED 0-2% SLOPES
211 PESCADERO CLAY LOAM PARTIALLY DRAINED
223 REIFF LOAM
230 RYDE CLAY LOAM, PARTIALLY DRAINED, 0-2% SLOPES
232 RYDE CLAY LOAM, SANDY SUBSTRATUM, PARTIALLY DRAINED, 0-2% SLOPES
252 STOMAR CLAY LOAM
253 STOMAR CLAY LOAM
268 VERNALIS CLAY LOAM
274 WILLOWS CLAY PARTIALLY DRAINED

PROJECT AREA

N

4000 0 4000 Feet

SCALE IS APPROXIMATE

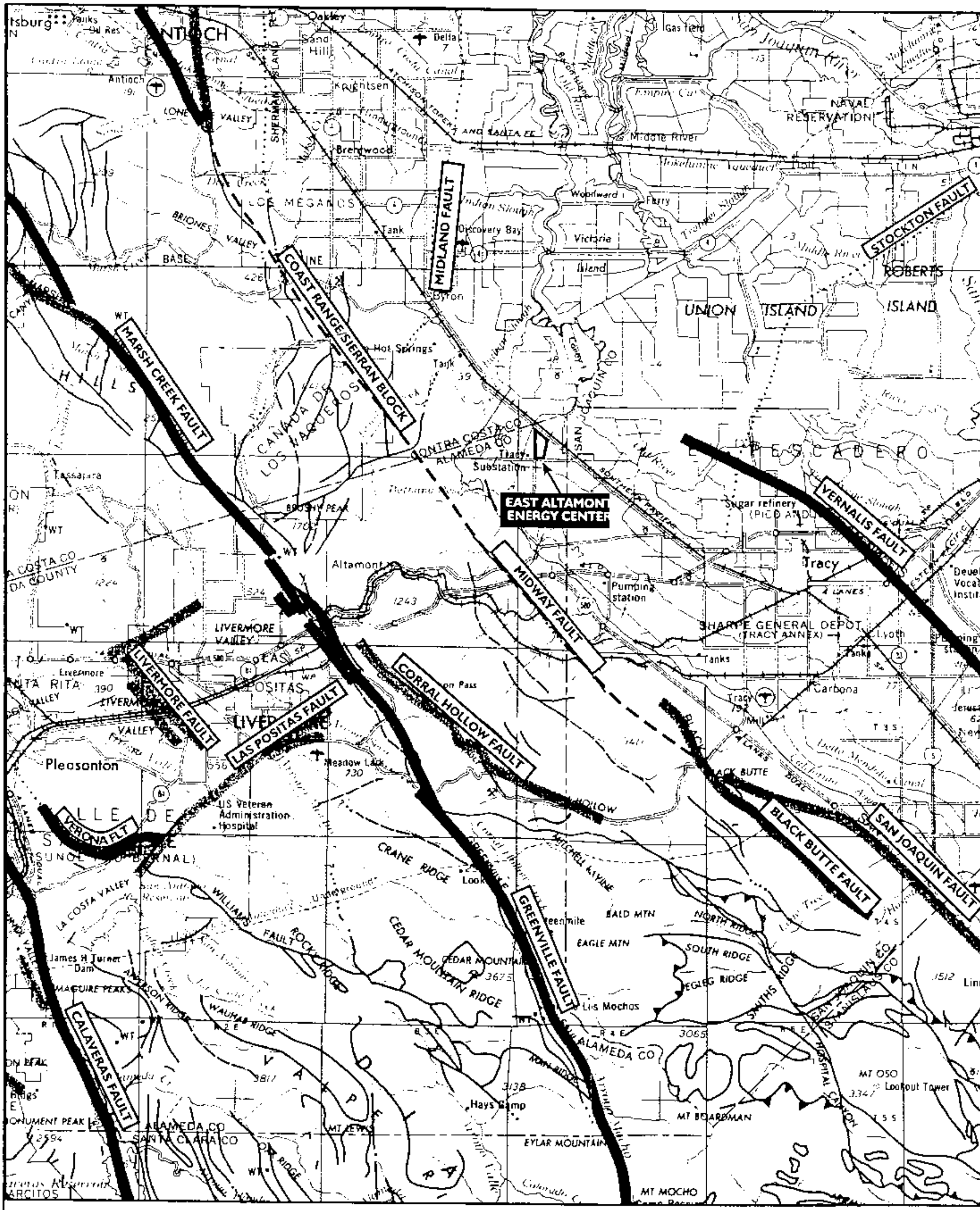
SOURCE: NRCS, 1966; 1977, 1981, 1992, 2000

FIGURE 5-3
PROJECT AREA SOIL MAP

EAEC ROWD

CH2MHILL

CH2M Hill RDD ArcView Project File \\Thor\Cart1\rddgis\east_alt\east_alt.apr 10:44 a.m. 06-12-2001



0 5

SCALE IN MILES

N

FIGURE 5-4
EAST ALTAMONT ENERGY CENTER IN RELATION TO PRINCIPAL FAULT ZONES

CALPINE EAEC REPORT OF WASTE DISCHARGE

Source: Application for Certification to CEC

E062001006SAC

SAC-E 161327.LS.10 Figure5_4.fh9 06/06/01

CH2MHILL

SECTION 6

Hydrogeology

The EAEC's location on the western edge of the San Joaquin Valley strongly influences local hydrogeologic conditions. Groundwater flow is generally away from the Coast Range, located approximately 3 miles to the southwest. The most productive groundwater units occur with the alluvial fans that were deposited off of the Coast Ranges. The sands, gravels, and clays of these alluvial fans are highly variable in vertical and lateral extent. The interfan areas have poor groundwater conditions (see Figure 5-1).

The project area overlies the Mountain House alluvial fan, which is approximately 150 to 200 feet thick (Clair Hill & Associates, 1964). The larger Kellogg Creek fan is located 8 to 10 miles northwest of the site. The Kellogg Creek fan is larger and more productive than the Mountain House fan. The Kellogg Creek fan supplies groundwater to several communities, including Discovery Bay and Brentwood. No community groundwater systems are located within the Mountain House fan.

Shallow groundwater in the Mountain House area moves from the upper reaches of the alluvial fans toward surface water features in the low lying delta areas. Available groundwater information near the project site indicates that shallow groundwater occurs at depths of zero to 10 feet below grade. Groundwater movement is very slow because of lack of irrigation pumping, permeability, and high water table in the Delta (Hill and Associates, 1964). Vertical groundwater movement is impeded by a relatively thin water-bearing section of less than 200 feet above the poorly permeable and strongly confined deeper aquifers. Groundwater recharge in the area occurs from percolation of applied irrigation water and canal seepage losses (Hill and Associates, 1964). Because of the shallow groundwater, farmers frequently tile their fields to enhance drainage and protect crops from root damage.

Specific key hydrogeologic issues are further discussed below.

6.1 Hydraulic Conductivity

Since the proposed evaporation ponds will be designed with double liners and a leachate collection and removal system, there will be no impact to the groundwater. Therefore, per Central Valley Regional Water Quality Control Board (CVRWQCB) guidance, information regarding hydraulic conductivity at this site is not pertinent to this Report of Waste Discharge.

6.2 Direction of Groundwater Flow

The regional direction of groundwater flow is toward the northeast, away from the Coast Range (Claire Hill and Associates, 1965) and is shown in Figure 5-1. Water level information collected from geotechnical borings drilled at the site (see Appendix C) indicate that the gradient is 0.008 in a direction of N15W (Figure 6-1).

6.3 Capillary Rise

Test pits were dug at several locations at the site to a depth of 7 to 8 feet. Kleinfelder reported that no groundwater or moisture associated with capillary rise was encountered in any of the test pits. Additionally, at selected borings, soil moisture measurements were performed on samples from varying depths. The data from these samples indicate that most samples collected from 6 feet below grade were not saturated (see Appendix E). Most of the samples from the 11- and 16-foot depths were saturated. Finally, Ron Heinzen of Kleinfelder indicated that these data are consistent with his experience in the EAEC area and that the capillary rise is estimated to be less than 1 foot (personal communication, June 6, 2001).

6.4 Springs

There are no known springs at the site.

6.5 Water Quality

6.5.1 Surface Water

Surface water bodies within a 1-mile radius of the site include the Central Valley Project (CVP) (i.e., the Tracy Pumping Plant) and the San Joaquin River. The Tracy Pumping Plant is located approximately one-half mile to the west of the project. The San Joaquin River is located approximately 1 mile northeast of the EAEC. Table 6-1 presents a summary of the surface water quality data taken from the local surface water purveyor, the Byron Bethany Irrigation District.

6.5.2 Groundwater

Groundwater quality data collected from the site is compared to that from a well located approximately 1 mile northeast of the site (Well 015/04E-33MOI) in Table 6-1. These data indicate that the native groundwater is brackish and of poor quality. Additional data that supports this conclusion is provided in Appendix F that presents a table of shallow groundwater quality in the area. These data were collected during planning for the proposed dewatering system for the nearby Mountain House development project.

TABLE 6-1
Summary of Local Surface and Groundwater Quality

Constituent	Units	Surface Water[a]	EAEC B-15[b]	1 Mile NE of EAEC[c]
Cations				
Calcium	mg/L	15		120
Magnesium	mg/L	18		98
Sodium	mg/L	28		760
Potassium	mg/L	4		3.4
Iron, dissolved	mg/L	0.03		NA
Manganese	mg/L	0.02		10

TABLE 6-1
Summary of Local Surface and Groundwater Quality

Constituent	Units	Surface Water[a]	EAEC B-15[b]	1 Mile NE of EAEC[c]
Anions				
Sulfate as SO_4	mg/L	30		640
Chloride	mg/L	33		980
Fluoride	mg/L	0.05		0.3
Nitrate as N	mg/L	0.06		14
Nitrite as NO_2	µg/L	NA		NA
Phosphate	mg/L	NA		0.02
Metals				
Aluminum	µg/L	NA		NA
Antimony	µg/L	NA		NA
Arsenic	µg/L	0.0017		6
Barium	µg/L	151		NA
Cadmium	µg/L	<1.0		NA
Copper	µg/L	0.004		NA
Lead	µg/L	0.0024		NA
Nickel	µg/L	<10.0		NA
Manganese	µg/L	0.02		10
Mercury	µg/L	<1.0		NA
Selenium	µg/L	0.0006		NA
Zinc	µg/L	0.007		NA
Other				
PH	std units	NA	7.71	7.5
Hardness	mg/L	230	NA	700
Total alkalinity	mg/L	NA	490	230
Bicarbonate alkalinity	mg/L	NA	<10	NA
Carbonate alkalinity	mg/L	NA	490	NA
Hydroxide alkalinity	mg/L	NA	<10	NA
Ammonium as NH_4	mg/L	NA	0.69	NA
Conductivity	µmhos/cm	NA	3600	4570
Total dissolved solids	mg/L	NA	2100	2980

[a] Data from Byron Bethany Irrigation District.
[b] Sample collected 5-23-01 by Kleinfelder. Additional analyses are still pending from the laboratory. These data will be provided supplementally to the CVRWQCB when received.
[c] Data from well sampled 6-6-79. Keeter, 1980.
[d] NA – analysis not conducted.

6.6 Background

6.6.1 Constituents of Concern (CoCs)

The data provided in Table 1-1 and the Basin Plan will be used as a basis for determining CoCs. These data will be used to establish the monitoring parameters set forth in Title 27, Section 21760 for the discharge into the evaporation pond, the vadose zone, and the groundwater monitoring program. As discussed with the CVRWQCB, the applicant will conduct 1 year of groundwater monitoring during the project construction phase to determine background water quality concentrations. The results of these data will be used to confirm the CoCs for the Waste Discharge Requirements.

Beneficial uses of groundwater bodies in the project vicinity are designated in the Basin Plan as agricultural supply, municipal and domestic water supply, industrial service supply, and industrial process supply. The following describes the contaminants of concern (CoCs) for each water supply category:

- Agriculture Supply – Primary CoCs are TDS, which may cause adverse affects to some sensitive plants.
- Municipal Supply – CoCs are defined as the Title 22 constituents for drinking water.
- Industrial Service Supply– Same as Title 22, these CoCs are less stringent than those for municipal and agriculture.
- Industrial Process Supply – Same as Title 22, these CoCs are less stringent than those for municipal and agriculture.

6.6.2 Proposed Monitoring Program

Monitoring associated with the two evaporation ponds and the wastewater recycle pond will consist of:

- Evaporation pond inflow and sludge monitoring
- Wastewater recycle pond inflow and sludge monitoring
- Groundwater monitoring
- LCRS monitoring

Sample collection, handling, and analysis will be conducted in accordance with standard procedures and as specified by the specific analyses to be performed. These procedures will be documented and maintained at the site for consistency in data collection practices. Analyses for this project will be conducted by laboratories approved by the State of California. Records of the sample collection, laboratory results, and equipment calibration will be maintained at the site.

6.6.2.1 Proposed Groundwater Monitoring Well Locations and Construction

Ten groundwater monitoring wells are proposed to monitor groundwater quality conditions upgradient and downgradient of the two evaporation ponds and the wastewater recycle pond. These well locations are shown on Figure 6-1. The three upgradient wells are considered to be the two that will be installed at the southern boundary of the site and the one well on the south of the wastewater recycle pond. The seven downgradient wells comprise five wells located on the north and west sides of the evaporation ponds and the two monitoring wells north and west of the wastewater recycle pond.

The two monitoring wells located just north of Kelso Road will be installed as one of the initial site construction tasks for collection of the 1 year of background data. The remaining monitoring wells will be installed after the completion of the construction of the site facilities.

Drilling permits will be obtained from Alameda County prior to installation of any monitoring wells. Well boring logs and construction diagrams will be maintained on-site with the other site monitoring records.

The well borings will probably be drilled using 6-1/4 inch hollow stemmed augers. Wells are proposed to be constructed of 2-inch, schedule 40 PVC. Well screens will be 10 feet long, with 0.010 inch slots, and placed across the water table. Wells will probably be approximately 20 to 25 feet deep. Wells will be protected with lockable tops and completed either above-grade or at-grade, depending on location and access issues. Figure 6-2 shows a generalized plan of monitoring well construction.

6.6.2.2 Proposed Constituents of Concern

Chlorides and total dissolved solids (TDS) are proposed as the primary CoCs for the EAEC ponds. Because of the high level of clays in the subsurface area beneath the ponds, it is anticipated that most metals will be retarded relative to the flow of groundwater. If a release from any of the ponds should occur, monitoring for metals will not be a good indicator that a release is impacting groundwater quality. Chlorides and TDS, on the other hand, are measurable parameters that have roughly the same travel time as groundwater. These parameters are also anticipated to be present at much higher concentrations in the ponds than in the groundwater and are important CoCs for the local agricultural land uses. Therefore, these parameters will provide the best data by which an assessment of pond impact on groundwater quality can be made.

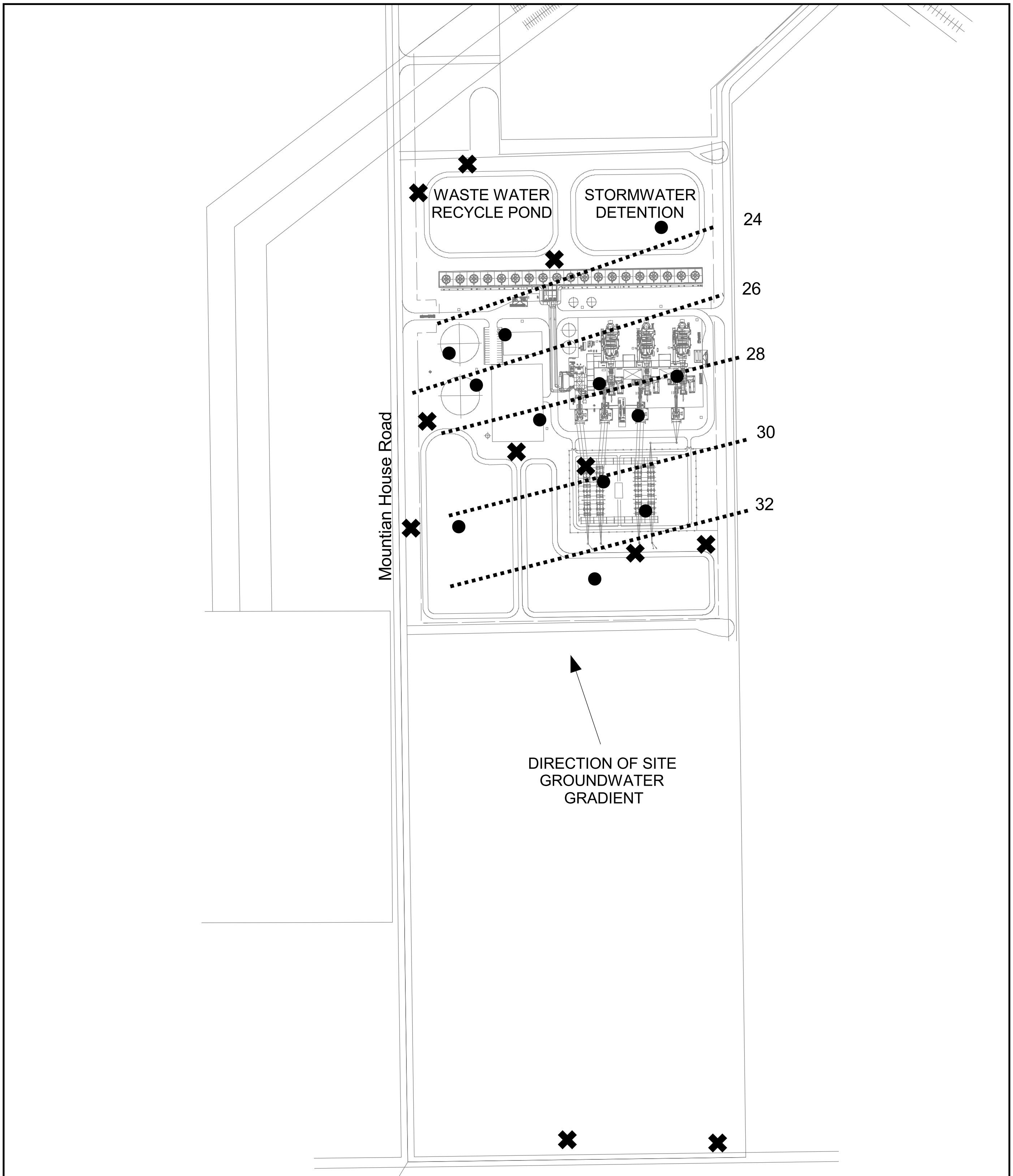
Calpine will work closely with the CVRWQCB to determine the planned periodicity and analyses to be conducted for the EAEC monitoring plan.

6.6.2.3 Reporting

Reporting will be as required by the CVRWQCB. Calpine proposes to provide a semi-annual report to the CVRWQCB summarizing the following:

- Summary of samples collected and analyses performed
- Analytical data for analyzed samples
- Volume of liquid discharged to the evaporation and wastewater recycle ponds
- Freeboard in each pond
- Record of pond cleaning
- Planned activities for the upcoming period
- Name and title of the person submitting the report

If after 5 years of uneventful monitoring and analyses, Calpine may request that the CVRWQCB consider reviewing the time period for reporting purposes. If the performance of the ponds and the plant operation warrant, and the CVRWQCB considers it appropriate, an annual monitoring summary may be reasonable.



LEGEND

- GROUNDWATER LEVEL MEASURING POINT
- PROPOSED MONITORING WELL LOCATION
- POTENTIOMETRIC LINE WITH ELEVATION (MSL)

May 30, 2001 data collected by Kleinfelder

N

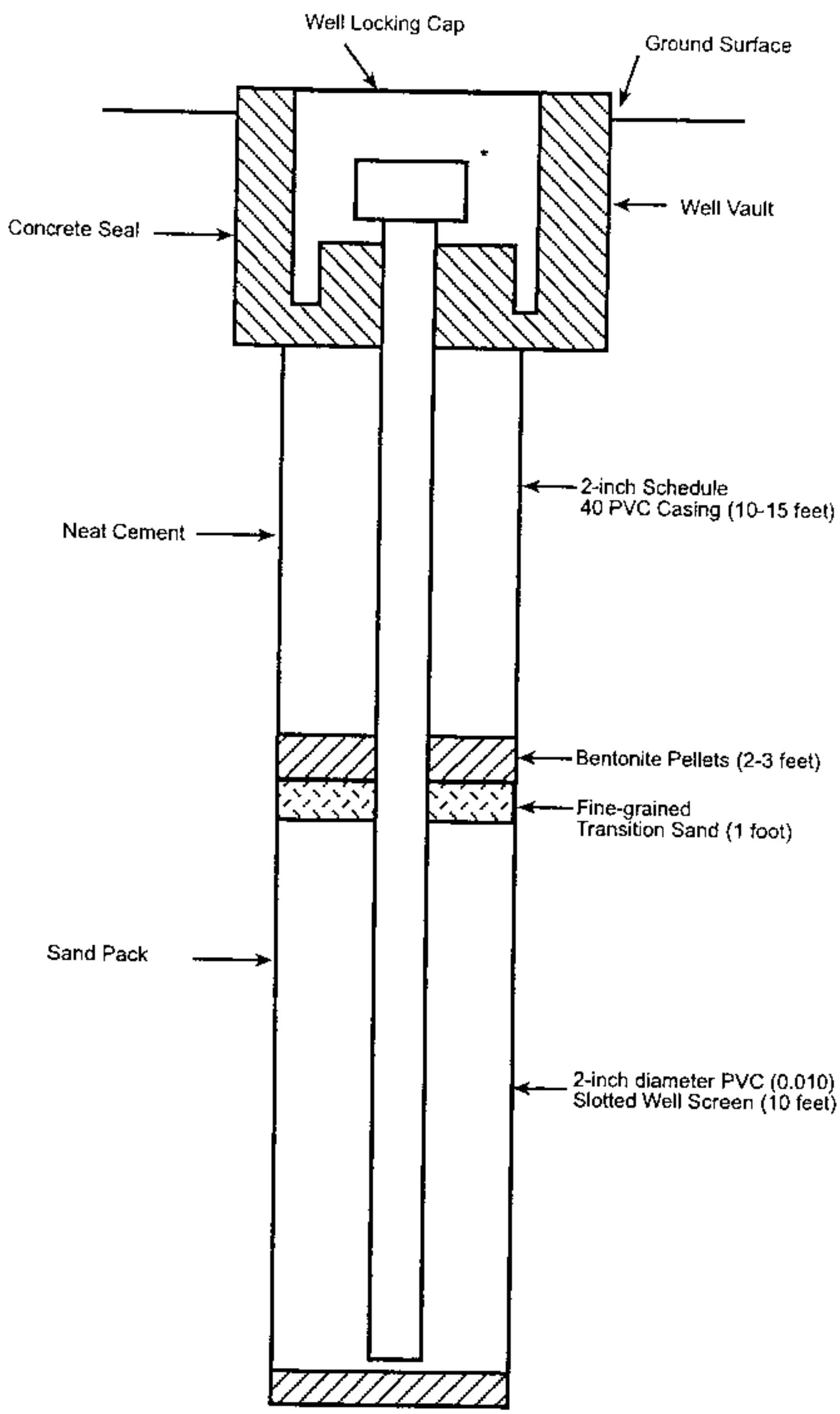
500 0 500 Feet

SCALE IS APPROXIMATE

FIGURE 6-1
SITE GROUNDWATER GRADIENT AND PROPOSED MONITORING WELL LOCATIONS

EAEC ROWD

CH2MHILL



* Well completion may also be above grade, depending upon well location and site drainage.

FIGURE 6-2
Proposed General Construction

SECTION 7

Land and Water Use

7.1 Well Map

Figure 7-1 shows the location of the known water wells within 1 mile of the EAEC project site. These wells were identified by review of Department of Water Resources (DWR) Water Well Drillers' Report files and a visual reconnaissance of the area.

7.2 Well Owners

The owners of most of the wells within a one-mile radius of the EAEC project site are identified in Table 7-1, located at the end of this section. This information was obtained from the Water Well Drillers' Reports and the Assessors' Maps from the counties of Alameda, Contra Costa, and San Joaquin.

7.3 Well Information

Well information for the nearest well to the EAEC project site is included in Table 7-1. If wells within the vicinity have Water Well Drillers' Reports filed with the DWR, then well data is included in Table 7-1 at the end of this section. If no report was filed, then no further information is available.

7.4 Land Use

The project site is located in northeastern Alameda County, near the Contra Costa and San Joaquin county borders. Agricultural land uses predominate in the planning area. In many cases, land uses are shared (e.g., grazing is permitted in some parks). The site is located on a 174-acre parcel near the northeast intersection of Mountain House Road and Kelso Road. The site is bounded to the north by Byron Bethany Road, to the south by Kelso Road, and to the west by Mountain House Road. The parcel is currently used for grazing and to farm oats, alfalfa, and hay crops, and occasionally row crops, such as tomatoes. The site had been previously used for dairy cows. Also, a single-family residence, which would be vacated prior to the construction and operation of the project, currently exists on the property.

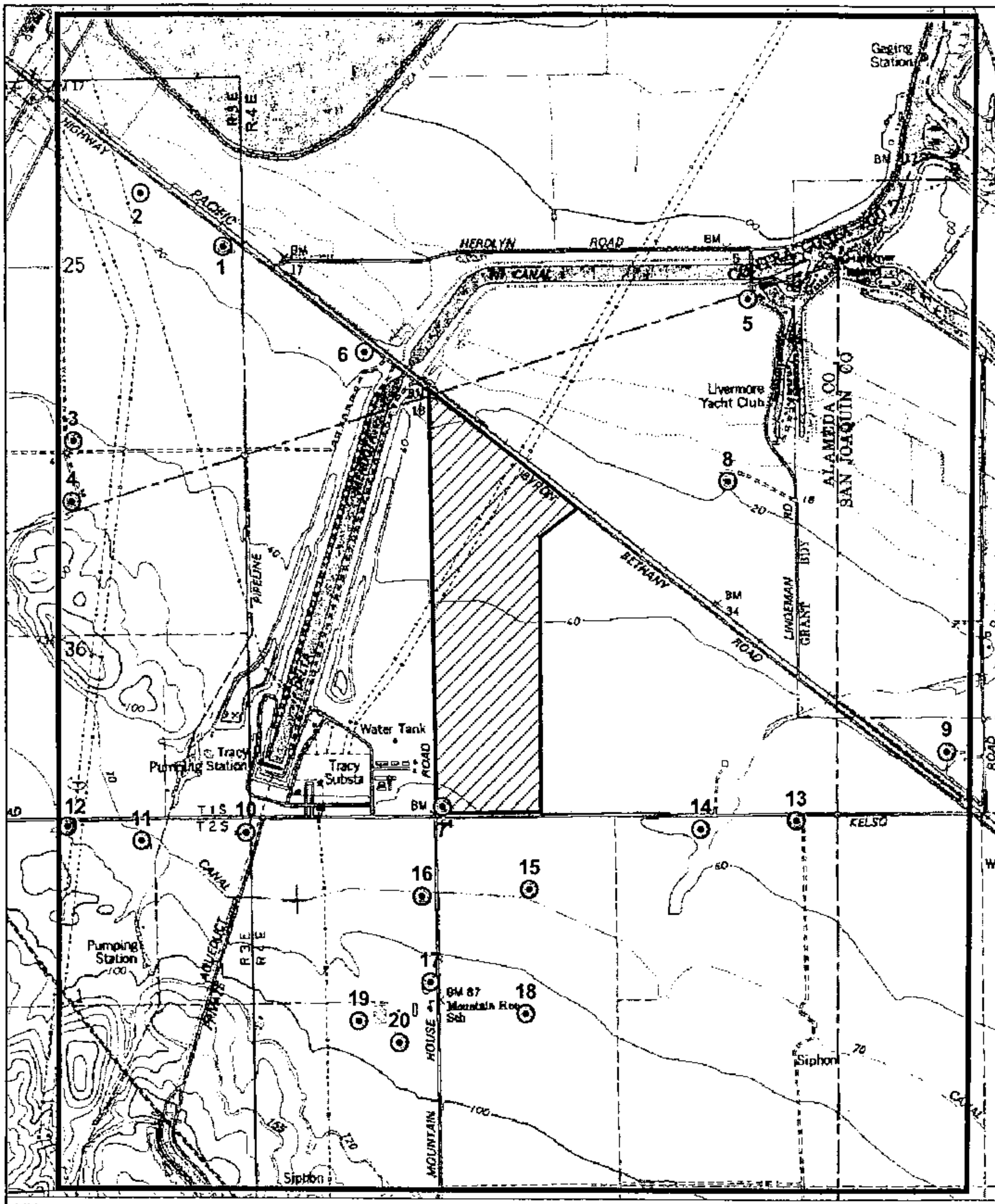
7.5 Groundwater Use

The current and estimated future use of groundwater within 1 mile of the facility perimeter is discussed at the beginning of Section 6 in this report.

TABLE 7-1
Summary of Available Well Data for Wells within One Mile of the EAEC Site

Map Number[a]	Well Location	Well Address or Location Description[b]	Current Landowner[c]	Well use	Year of construction	Total depth (ft)	Diameter of casing at surface (in)	Diameter of casing at total depth (in)	Type of casing	Perforated interval	Well seal depth (ft)	Recorded depth to water (ft)	Name of well driller	Address of well driller	Well test information	Type of logs available	Comments
1	T1S R3E Sec 25H	25 Byron Road 3/4 miles west of junction Mountain House Rd	Chevron USA	irrigation	1958	80	8	8	Steel	43 - 60 ft	n/a	31.5	Western Well Drilling Co. Ltd.	P.O. Box 47 San Jose	none	driller	Well identified by well log. Appears to be in same location as well observed during visual reconnaissance.
2	T1S R3E Sec 25H	Byron Bethany Rd 1/4 mile south of Bruns Rd	Martin Enos												none	none	Identified through visual reconnaissance. No well data available.
3	T1S R3E Sec 30L	Approx 2800 ft east of Bruns Rd	Martin Enos												none	none	Identified through visual reconnaissance. No well data available. Well head treatment.
4	T1S R3E Sec 36 100	Just north of Contra Costa/Alameda County line and approx 2,900 ft east of Bruns Ave	Bruns Properties												none	none	Two small diameter wells that appear to be monitoring wells or piezometers. Identified through visual
5	T1S R4E Sec 29L	Southwest of Lindeman Rd and Alameda/Contra Costa County lines	Evelyn Costa												none	none	Identified through visual reconnaissance. No well data available.
6	T1S R3E Sec 30 L	Adjacent (S) to Byron Bethany Rd and ~300 ft NW of Delta Mendota canal	Daniel Simonich												none	none	Identified through visual reconnaissance. No well data available.
7	T1S R3E Sec 31Q	Northeast corner of Mountain House and Kelso Rds	Thelma Holck												none	none	Probable well onsite, however no visual confirmation of well presence.
8	T1S R3E Sec 32 C	2,000 ft SW of Livermore Yacht Club	Evelyn Costa												none	none	Identified through visual reconnaissance. No well data available.
9	T1S R3E Sec 32 R	West side of Kelso Rd, 500 ft north of Byron Bethany Rd	Trimark Communities												none	none	Identified through visual reconnaissance. No well data available.
10	T2S R3E sec 1A	15991 Kelso Rd	Laverne Peterson	domestic	1981	133	6	6	plastic	not specified	35 ft	not specified	Ernest Dejesus	Rt. 1 Box 215C Brentwood	yes, by driller	driller	
11	T2S R3E sec 1B	15559 Kelso Rd	Napoleon Pangilinan	domestic	1990	60	6	6	plastic	30 - 60 ft	20 ft	22	Hennings Bros Drilling Co., Inc.	3525 Pelandale Ave. Modesto	none	driller	
12	T2S R3ECSec 1C	South of Kelso Rd, 1/2 mi east of Bruns Rd	Steve Lee	domestic	1990	145	6	6	plastic	125 - 145 ft	30 ft	26	Hennings Bros Drilling Co., Inc.	3525 Pelandale Ave. Modesto	none	driller	
13	T2S R4E Sec 5C	Kelso Rd, 1/2 mile west of Byron Bethany Rd	Albert Dexter												none	none	Identified through visual reconnaissance. No well data available.
14	T2S R4E Sec 5D	Kelso Rd, 3/4 mile west of Byron Bethany Rd	Albert Dexter	residential?											none	none	Residence. Probable well onsite, however no visual confirmation of well presence.
15	T2S R4E Sec 6A	Southeast of junction Mountain House and Kelso Rds	Werner Schropp	piezometer	1988	20	2	2	plastic	10 - 20 ft	2 ft	10	Spectrum Drilling	2825 E. Myrtle St. Stockton	none	driller	
16	T2S R4E Sec 6C	1,500 ft north of Mountain House School on Mountain House Rd	Anthony Castello												none	none	Identified through visual reconnaissance. No well data available.
17	T2S R4E Sec 6F	4284 Mountain House Rd	Anthony Costello	domestic	1993	190	6	6	PVC	150 - 190 ft	n/a	12	Hennings Bros Drilling Co., Inc.	3525 Pelandale Ave. Modesto	none	driller	
18	T2S R4E Sec 6K	Approx 1,500 ft east of Mountain House School	Werner Schropp	piezometer	permitted in 1988	26	2	2	plastic	10 - 26 ft	0 - 8 ft pollution seal	25	Spectrum Drilling	2825 E. Myrtle St. Stockton	none	driller	
19	T2S R4E Sec 6L	3880 Mountain House Rd	Werner Schropp	domestic	1993	130	6	6	plastic	100 - 130 ft	30 ft	25	D&S Dragline Inc	PO Box 705 Los Banos	none	driller	
20	T2S R4E Sec 6F	3880 Mountain House Rd	Werner Schropp	domestic	1995	150	6.125	6.125	A-3C	35 - 55 ft and 130-150 ft	n/a	22	Woods Well Drilling	PO Box 237 Herald	none	driller	

Notes:
a See Figure 7-1 for well location
b Well location based on DWR Water Well Driller's Reports, when available, or visual well identification
c Well owner data from County Assessor's map



LEGEND

17 WELL (NUMBER CORRESPONDS TO MAP NUMBER ON TABLE 7-1)

LINE DEFINING 1 MILE RADIUS FROM EAEC

PROJECT SITE

N

0.5 0 0.5 Miles

SCALE IS APPROXIMATE

FIGURE 7-1
LOCATION OF NEARBY WELLS

EAEC ROWD

CH2MHILL

CH2M Hill RDD ArcView Project File \\Thor\Cart1\rddgis\east_alt\east_alt.apr 9:11 p.m. 06-7-2001

SECTION 8

Operational Plan

8.1 System Operation

The only process waste stream generated at the EAEC and discharged to the ponds will be concentrated brine solution from the brine concentrator. The concentrated brine solution will flow to either one of the two evaporation ponds.

Water collected in the evaporation ponds will be allowed to evaporate. Solid material collected in the evaporation ponds will be removed, if necessary, to maintain the required operating capacity. Removal of accumulated solids will be accomplished by a combination of brooms, shovels, lightweight mechanical equipment, and vacuum trucks. Removed solids will be analyzed to determine appropriate disposal methods. If cleaning is required because of a detected leak in the primary liner, the cleaning effort will be restricted to the localized area requiring repair.

8.2 Contingency Plan

Since the evaporation ponds are double lined with a LCRS, the detection of a leak in the primary liner does not pose an immediate problem and allows time to schedule the repair work during the spring to fall time period (i.e., the highest evaporation and lowest storm water flow months). Activities generating wastewater will be curtailed as much as possible. In planning for the liner repair, wastewater will be routed to the other evaporation pond, and the wastewater recycle pond, if necessary.

After increased flows from the Station-Analyzer are identified, the pond will be taken out of service if possible (assuming the other pond is available). The leak will be located by electrical leak detection and location methods such as performed by I-CORP, Ocean Ridge, Florida. After the leak is located, the pond will be dewatered, sludge removed in at least the leak area, and the concrete will be removed to expose an area of sufficient size to access the liner and allow repairs to be made. A new section of the concrete revetment liner will be placed to complete the repair and the pond returned to service.

In the event of a leak that has the potential for a release to the environment, emergency notification procedures will be initiated to inform the appropriate agencies in accordance with local, state and federal laws and regulations.

8.3 Inspection and Maintenance

Calpine will develop and implement an inspection and maintenance plan. Weekly inspections will include observations of:

- The condition of the evaporation pond
- LCRS monitoring systems

- Vadoze zone monitoring system under the leak detection manhole

During inspections, each system will be checked for proper operation, needed maintenance activities, presence of fluid in the leak detection systems, and signs of releases.

An inspection checklist will be prepared by the facility operator. This checklist will be used by the facility operator to guide inspection activities. An inspection log will be maintained at the EAEC. The log will include the following information for each inspection:

- Date of the inspection
- Person performing the inspection
- Checklist for components inspected
- Results of inspection
- A description of any observable problems
- The date the problem was resolved
- Actions taken to resolve the problem

A maintenance log will also be kept at the facility. The log will include documentation of scheduled and unscheduled maintenance activities performed on the evaporation ponds.

SECTION 9
Preliminary Closure Plan

- When the evaporation ponds are no longer required, they will be clean closed (i.e., all wastes and contaminated material will be removed for disposal at an appropriate facility).
- Solids that may have accumulated in the evaporation ponds will be profiled to determine the appropriate disposal method. They will then be removed from the evaporation ponds using a combination of pressure washing with fire hoses, lightweight mechanical equipment, vacuum trucks and/or brooms and shovels. The removed solids will be disposed of off-site at an appropriately permitted facility.
- The evaporation ponds lining system and ancillary facilities will then be removed. This material will be recycled, if possible, or disposed of at appropriately permitted off-site facilities.
- The areas will then be regraded to reestablish natural contours, surface drainage patterns, and vegetation.

Because the evaporation ponds will be clean closed, no postclosure maintenance of the site will be necessary.

9.1 Preliminary Closure Cost Estimate

A preliminary closure cost estimate has been prepared for the clean closure scenario described above. The estimated cost for clean closure of the evaporation ponds is approximately $6 million (expressed in terms of 2001 dollars). Details of the closure cost estimate are presented in Table 9-1 at the end of this section.

Since the evaporation ponds will be clean closed, there are no postclosure maintenance costs anticipated for the site.

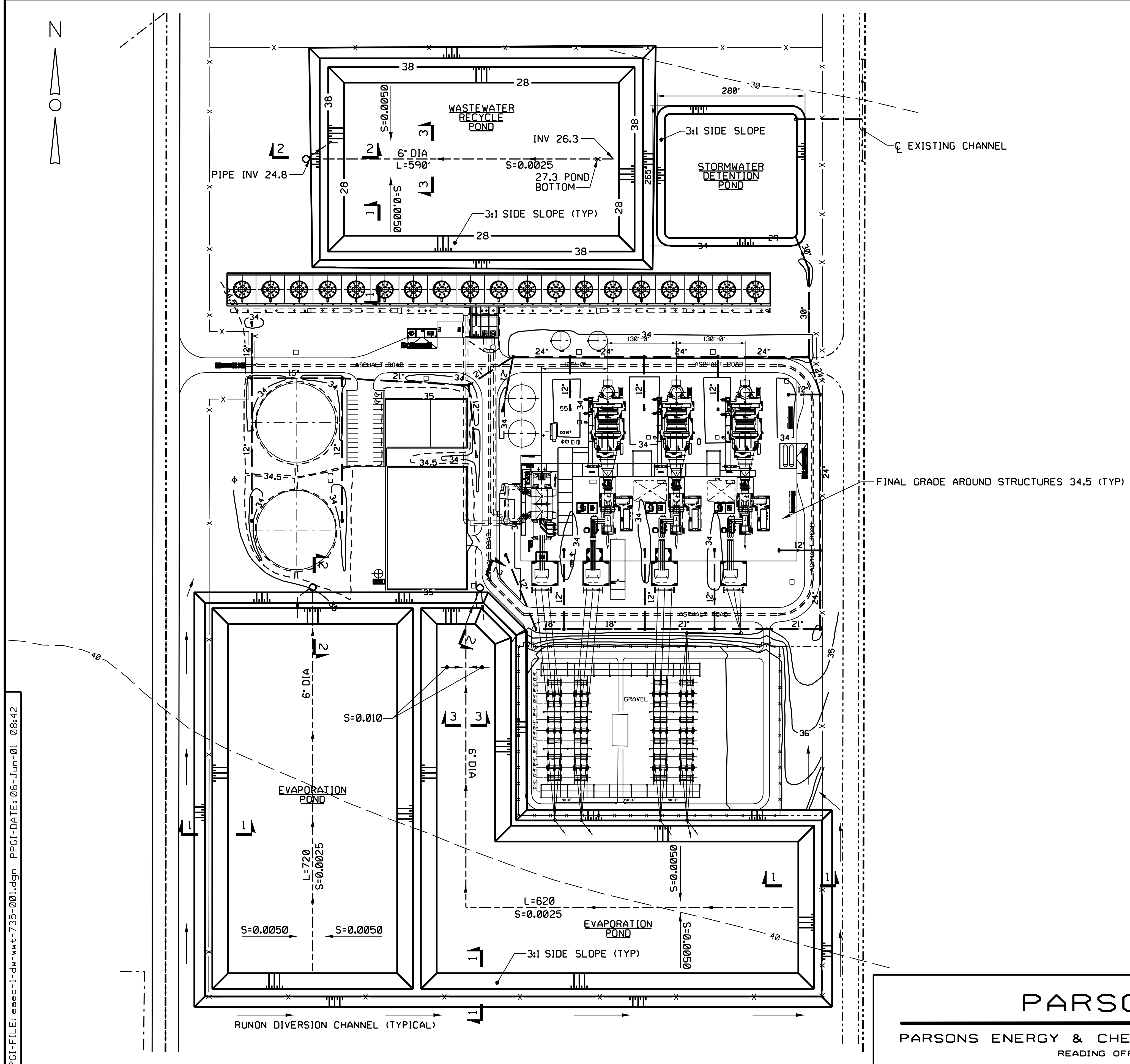
TABLE 9-1
Estimated Cost for Closure of Evaporation and Wastewater Recycle Ponds
East Altamont Energy Center

Item	Estimated Cost ($)*
Sludge, and Subsurface Sampling	
Sample Cost (20 samples @ $250/Sample)	$5,000
Labor (40 hours at $75/Hour)	$3,000
Sludge Removal**	
Removal (21,000 cy@ $30.50/cy)	$640,500
Disposal (21,000 cy@ $45/cyd)	$945,000
Removal and Disposal of Concrete (14,400/cy @ $150/cy)	$2,160,000
Removal of HDPE Pond Liners	
Removal (18 acres @ $8,000/acre)	$144,000
Disposal (30,000 cy @ $5/cyd)	$150,000
Final Grading (18 acres @ $7,400/acre)	$133,200
Well Demolitions (11 wells @ $3,750 well)	$41,250
Subtotal Construction Costs	**$4,221,950**
Contractor Overhead (10%)	$421,800
Contractor Profit (6%)	$278,400
Mob/Bonds/Insurance (5%)	$245,900
Field Detail Allowance (2.5%)	$129,100
Construction Contingency (15%)	$794,000
Use Estimated Project Total	**$6,091,150**

*Based on current costs.
**Assuming accumulation of 1 foot of nonhazardous sludge.

APPENDIX A

Preliminary Engineering Package (Conceptual Design Drawings and Specifications)



LEGEND

30	EXISTING GRADE CONTOUR
35 / 34.5	FINAL GRADE CONTOUR
24"	STORMWATER DRAINAGE PIPE
▪	INLET

1"=200' — 0 100 200 300 — SCALE IN FEET

EAST ALTAMONT ENERGY CENTER

PARSONS

PARSONS ENERGY & CHEMICALS GROUP INC.

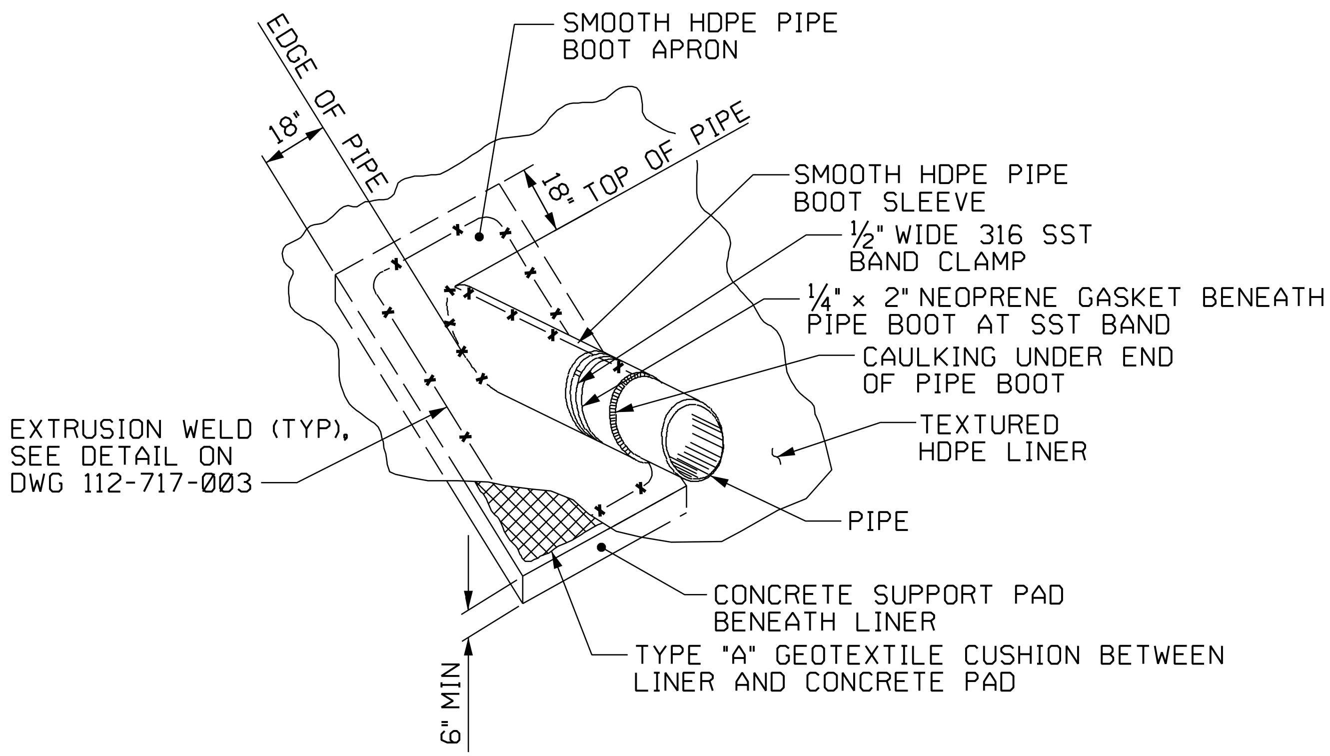
READING OFFICE

EVAPORATION PONDS PLAN

PARSON'S DWG.NO. EAEC-1-DW-WWT-735-001

REV A

PPGI-FILE: eaec-1-dw-wwt-735-001.dgn PPGI-DATE: 06-Jun-01 08:42

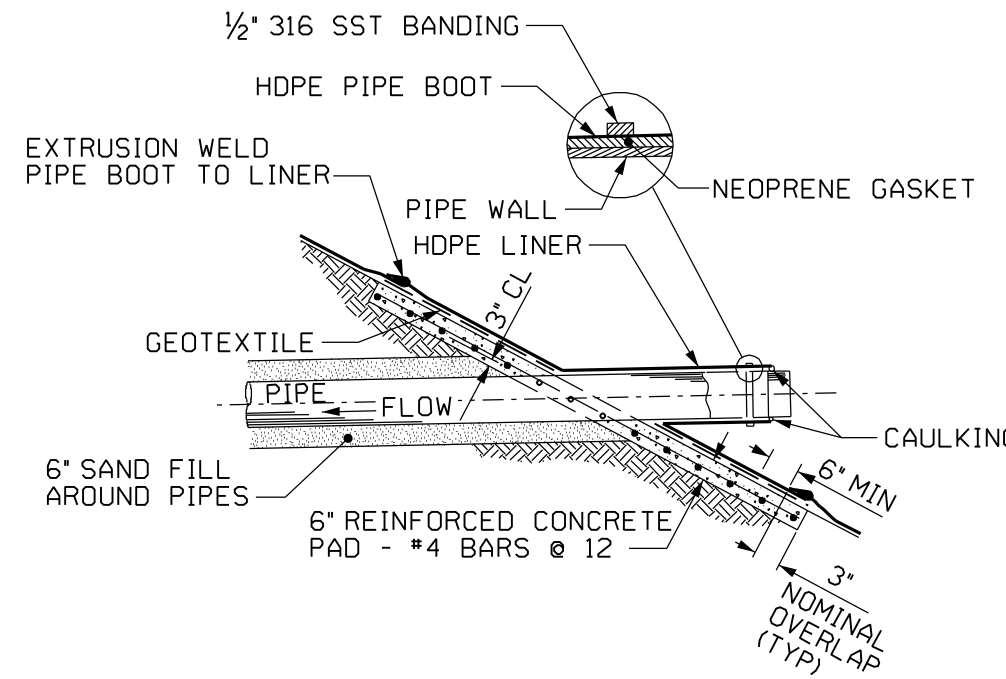


NOTE:

1. CONCRETE SURFACES SHALL BE STEEL TROWEL FINISHED WITH EDGES ROUNDED AND SMOOTHED.
2. MINIMUM CONCRETE STRENGTH SHALL BE 4000 PSI .

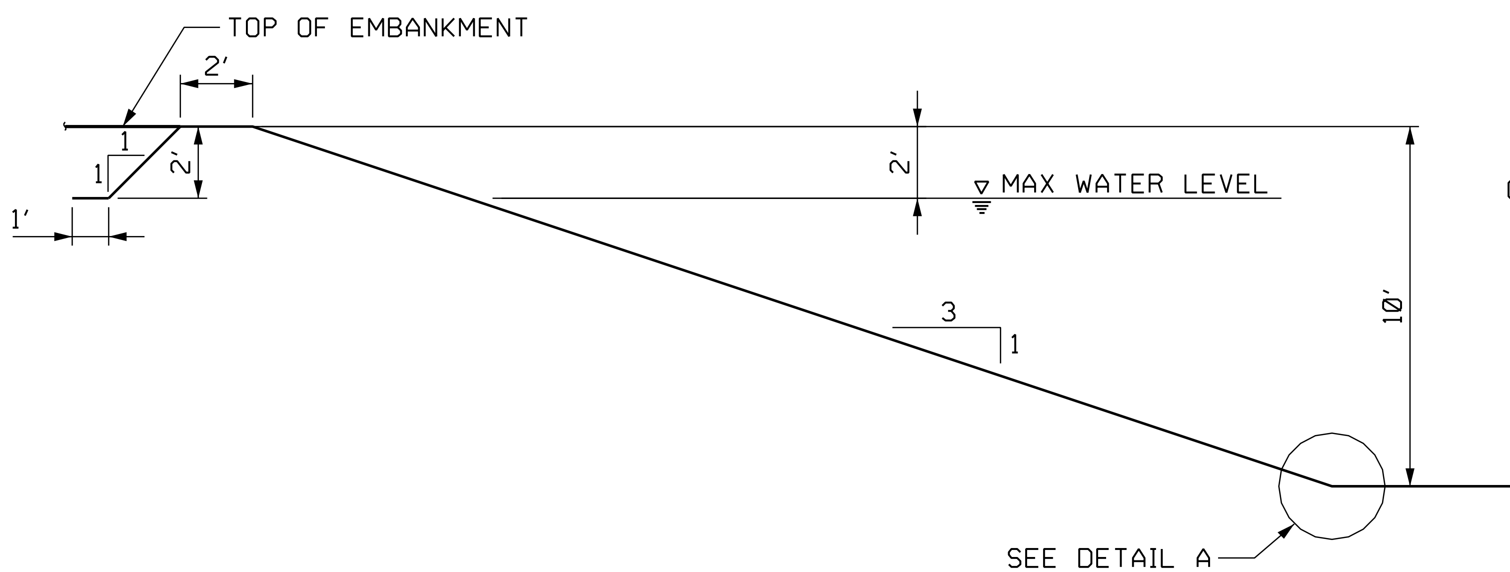
PIPE BOOT ISOMETRIC

NO SCALE



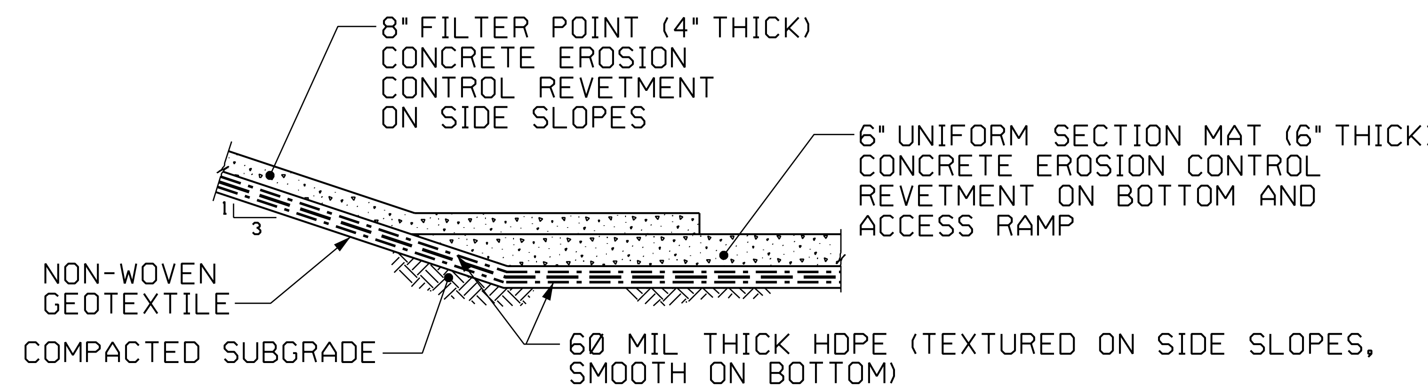
PIPE BOOT DETAIL

NO SCALE



SECTION 1-1

NO SCALE



NOTE: VADOSE SYSTEM WILL BE LIMITED TO THE AREA UNDER THE LEAK DETECTION MANHOLE AND WILL BE EXTERNAL TO THE PONDS

DETAIL A

EAST ALTAMONT ENERGY CENTER

PARSONS

PARSONS ENERGY & CHEMICALS GROUP INC.

READING OFFICE

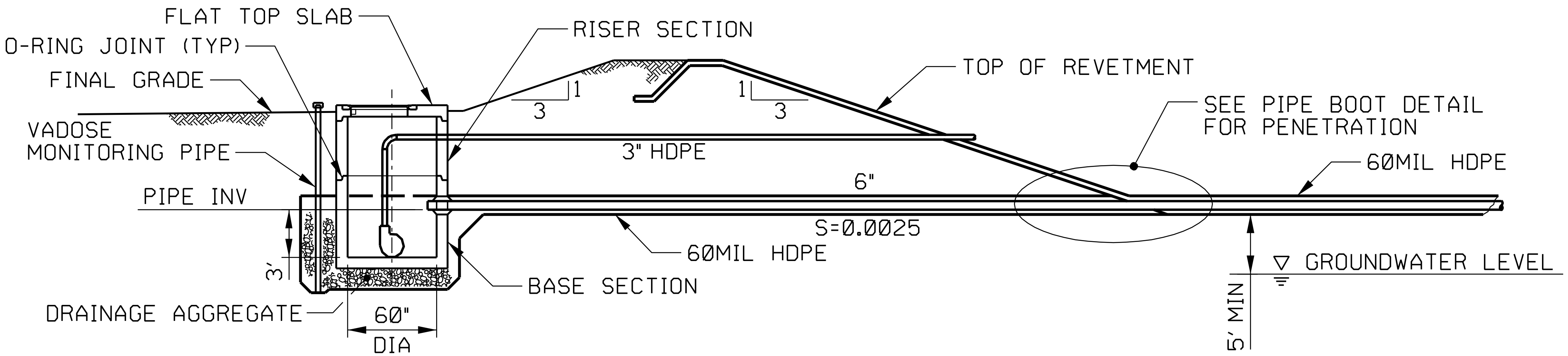
EVAPORATION PONDS

SECTIONS AND DETAILS

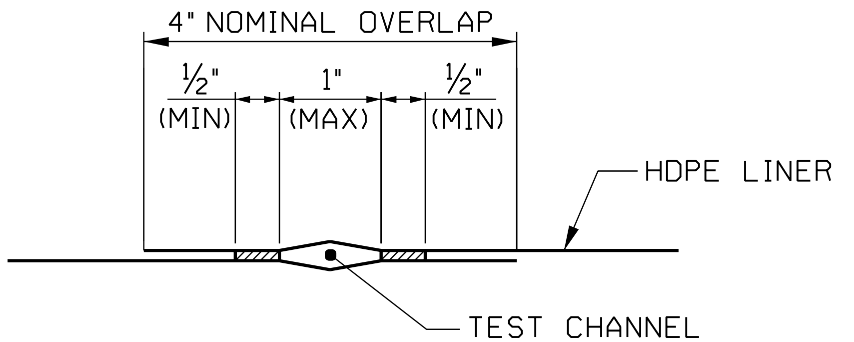
PARSON'S DWG.NO. EAEC-1-DW-WWT-735-002

REV A

PPGI-FILE: eaec-1-dw-wwt-735-002.dgn PPGI-DATE: 06-Jun-01 08:42



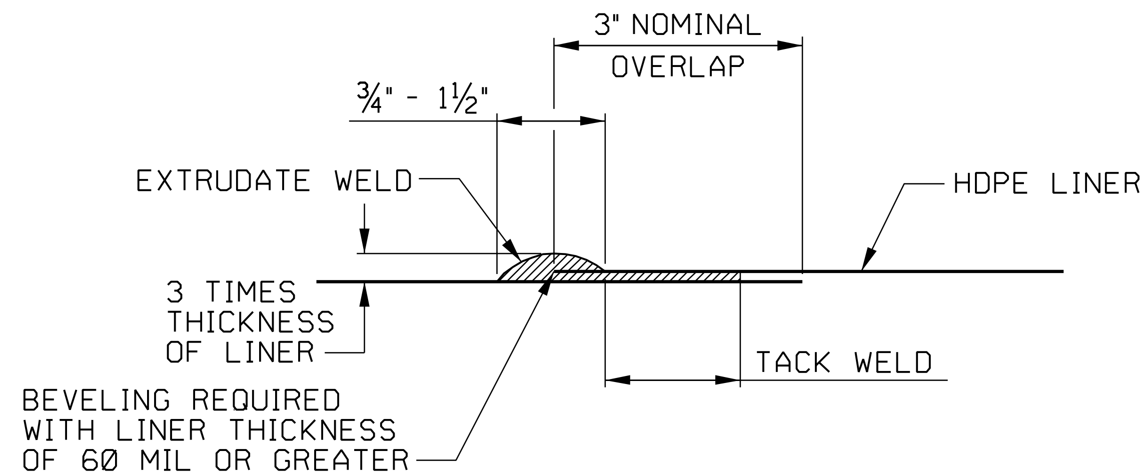
SECTION 2-2



NOTES:

1. DOUBLE FUSION WELDING SHALL BE THE PRIMARY SEAMING TECHNIQUE USED.
2. AIR PRESSURE OR VACUUM TESTING SHALL BE THE NON-DESTRUCTIVE SEAM TEST METHODS FOR DOUBLE FUSION WELDS.

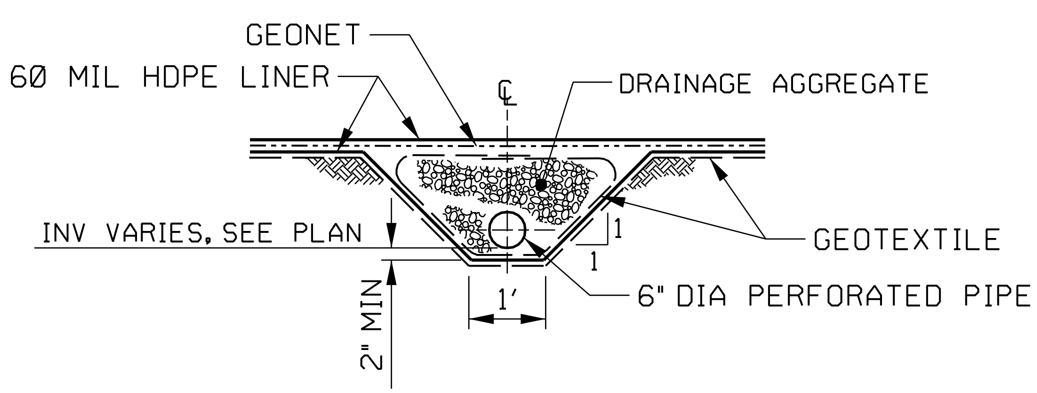
DOUBLE FUSION WELD



NOTES:

1. LINER SHEETS SHALL BE TACK-WELDED TOGETHER AT OVERLAP TO FORM TEMPORARY BOND PRIOR TO WELDING.
2. GRINDING NOT TO EXCEED ¼" PAST "SQUEEZE-OUT" ON EITHER SIDE. PROPER CARE SHOULD BE TAKEN IN NOT REMOVING TOO MUCH MATERIAL WHEN GRINDING.
3. VACUUM TESTING SHALL BE THE NON-DESTRUCTIVE SEAM TEST METHOD FOR EXTRUSION WELDS.

EXTRUSION WELD



LEAK COLLECTION PIPE DETAIL

NO SCALE

EAST ALTAMONT ENERGY CENTER

PARSONS

PARSONS ENERGY & CHEMICALS GROUP INC.
READING OFFICE

EVAPORATION PONDS
SECTIONS AND DETAILS

PARSON'S DWG.NO.	REV
EAEC-1-DW-WWT-735-003	A

Qualifications and Responsibilities

The CQA Plan will be implemented by the CQA Team with the qualifications and responsibilities described below.

CQA Officer

The CQA Officer will have formal academic training in engineering, engineering geology, or a closely related discipline and will be a registered civil engineer or a certified engineering geologist in the State of California. The Officer should have practical, technical, and managerial experience to properly implement the CQA Plan. The CQA Officer must be able to communicate effectively with landfill personnel, design engineers, and Contractors to facilitate a clear understanding of construction activities and the CQA Plan.

The CQA Officer will be responsible for monitoring implementation of the plan, inspections, construction observations, sampling, and testing oversight. The CQA Officer's major duties and responsibilities will be as follows:

- Review all design plans and specifications for accuracy and completeness. If clarifications or adjustments are required in the design plans or specifications, the CQA Officer will contact the design engineer and resolve the issue
- Educate CQA personnel about CQA requirements and procedures pertaining to construction of the liner and the LCRS
- Prepare a schedule of CQA inspection activities and coordinate necessary CQA personnel to conduct inspections
- Review and interpret data and reports prepared by CQA inspection personnel
- Identify and recommend work that should be either accepted or rejected on the basis of observations and/or test results (the Officer may require special testing, inspections, or approval in areas of questionable quality or deviations from design specifications)
- Monitor the Contractor's quality control program
- Record the Contractor's certification of subsurface acceptability, geomembrane material warranty, Contractor's certification of acceptable installation, and geomembrane installment warranty

CQA Inspection Personnel

CQA inspection personnel will have formal training and practical experience in inspecting and testing construction work, including conducting and recording inspection activities, preparing daily reports, and performing field testing. In addition, knowledge of codes and regulations involving materials handling, observation of testing procedure, equipment, and reporting procedures will be required.

The CQA inspection personnel will perform various tests and observations during construction such as:

- Ensuring that all testing equipment is properly calibrated on a regular basis and that the calibration is documented
- Accurately recording all test data and organizing them in a manner that allows easy reference
- Evaluating the Contractor's construction quality control plan to ensure that it meets or exceeds the CQA Plan requirements
- Reporting observations and test results as the work progresses

The supporting CQA inspection personnel will work under the supervision and guidance of the CQA Officer. Inspection personnel will perform onsite inspections of the liner and LCRS construction and determine whether the work meets the requirements of the project plans and special provisions. Field tests and visual observations will be used to evaluate construction practices. If CQA personnel observe poor construction practices, the CQA Officer will be notified immediately. CQA inspection personnel will be responsible for verifying that all testing is conducted in accordance with American Society for Testing Materials (ASTM) standards or other specified test methods and that the proper test equipment is used. The results of all inspections, including work that is unacceptable, will be reported to the CQA Officer.

Contractor

The Contractor is responsible for constructing the liner and LCRS in conformance with plans, special provisions, and this CQA Plan. The Contractor is also responsible for all work performed by the subcontractors. The Contractor will perform the work in accordance with the Contract Documents. The Contractor must be qualified to perform the respective work items and must allow and assist the CQA team to perform the required monitoring.

The Contractor will perform materials acceptance testing as required by the project special provisions. In addition, the Contractor will provide all equipment to perform testing of geomembrane test and production seams as required by the special provisions. The Contractor shall provide all necessary equipment required to complete the work in accordance with the special provisions.

Project Meetings

Meetings will be held throughout construction to enhance communication among the Owner, the CQA Officer, the CQA inspection personnel, and the Contractor. These meetings will aid the organizations involved with construction activities in becoming familiar with facility design, construction procedures, and recent design changes, if any.

Meetings to be conducted include the following:

- Preconstruction meeting
- Progress meetings
- Problem or work deficiency meetings (as needed)

Preconstruction Meeting

A preconstruction meeting will be held before construction activities begin. The meeting will be attended, at a minimum, by the Engineer, Owner Staff, the CQA Officer, the Contractor, and the Subcontractors. This meeting will be held to resolve uncertainties regarding facility design, CQA Plan, and/or construction procedures. The CQA Officer or CQA inspection personnel in attendance at the meeting will record and distribute minutes of the meeting to all parties. This meeting will include the following activities:

- Each party will be supplied with relevant documents and supporting information.
- The CQA Plan will be explained with respect to design criteria, plans, and special provisions.
- Any changes to the CQA Plan that are needed to meet or exceed the specified design will be identified.
- Each party's responsibilities will be reviewed and discussed, with communication lines identified.
- Key personnel will be identified.
- The project schedule will be reviewed.
- Protocol for field observations and field tests will be explained.
- Protocol for handling construction deficiencies, repair work, and retesting will be discussed.
- Protocol for document reporting, handling, distribution, and storage during construction will be discussed.
- Procedures to protect construction materials from adverse effects of weather during construction and storage will be discussed.
- Work area and safety protocols will be discussed.

- A site inspection will be conducted to discuss work areas, work plans, stockpiling, and laydown areas, and other site or construction issues.

Progress Meetings

Progress meetings will be held at least weekly to review activities or progress, discuss present and future work, and discuss any current or potential construction problems. The meeting should be attended by the Owner, the CQA Team, and the Contractor, at a minimum. The CQA Team will record the results of these meetings in their daily construction inspection diary.

Problem or Work Deficiency Meetings

When a problem or deficiency occurs or is likely to occur, special meetings will be held to deal with it instead of waiting for the progress meeting. These meetings will be attended by the Owner, the CQA Team, and the Contractor and, if necessary, the Engineer. The purpose of these meetings is to identify a problem or deficiency in the construction work, review alternative solutions, and select and implement a plan to resolve the problem or deficiency. The CQA Team will record and distribute minutes of the meeting to all parties.

Inspection Activities

The CQA Team will conduct inspection activities throughout construction of the liner and LCRS to document compliance with project plans and special provisions. These activities are divided into preconstruction, construction, and post-construction activities.

Preconstruction

The CQA Officer will conduct preconstruction training and information sessions with CQA personnel to familiarize them with the specified design, the inspection policies, and the procedures. Preconstruction inspection activities of the CQA team will include the following:

- Reviewing and becoming familiar with all design criteria, drawings, and specifications associated with construction of the liner and LCRS components
- Looking for inconsistencies in the design plans and special provisions. Any inconsistencies will be discussed with and resolved by the Engineer
- Reviewing existing reports that pertain to construction of the liner and LCRS
- Reviewing Contractor's certifications, submittals, test results, sources, and samples of earth and synthetic materials for control testing requirements described in the special provisions and this CQA Plan
- Inspecting stockpile and borrow areas
- Inspecting synthetic materials, finished product specifications, and manufacturer's test results
- Verifying receipt of all synthetic materials documentation required in the special provisions before synthetic materials are accepted
- Observing transportation, unloading, handling, and storage procedures for the synthetic materials for any damage that may occur; damaged synthetic materials may be rejected
- Reviewing Contractor's proposed construction procedure for design and special provisions compatibility and constructibility
- Verify that geosynthetic materials are stored in a dry, protected area

Construction

General

Construction inspection activities of the CQA team will include the following:

- Verifying that materials are as specified or approved by the design engineer and CQA Officer
- Recording any damage to the compacted layers or synthetic materials resulting from operation of equipment
- Observing all phases of construction and documenting the Contractor's compliance or noncompliance with the approved plans, special provisions, and the directions of the Owner or CQA Officer
- Verifying that equipment does not damage stored or deployed synthetic materials by handling, trafficking, leakage, or other means
- Verifying that workers on the synthetic materials do not smoke, wear shoes that could damage the materials, or engage in activities that could damage the materials
- Review Contractor submittals, samples, and supporting test reports and verifying that all documentation required by the special provisions have been received and are in compliance
- Verifying that all lines and grades have been verified by the project surveyor before subsequent component construction
- Verifying that the leachate collection pipe has been perforated and installed as required by the project plans and specifications
- Verifying that the leachate collection manhole is installed as required and is protected from future operations and construction

Earth Materials

The construction inspection activities of the CQA Team with respect to the earth components of the liner and LCRS will include the following:

- Inspecting for and verifying the removal of irregularities and protrusions in the foundation material before proceeding to the subsequent layers
- Verifying that placement of earth materials does not damage underlying synthetic components
- Verifying that cracks, depressions, and irregularities are filled in and compacted to the specified relative compaction
- Testing material characteristics as described in the special provisions and this CQA Plan
- Measuring compacted lift thickness, which must not exceed the special provision requirements
- Periodically testing the relative compaction and moisture content of each lift of compacted subgrade material; where field density tests or moisture contents fail to meet specified values, notify the Contractor to rework the area or remove the material
- Observing the type of equipment and number of passes used in compaction and identifying areas that have been poorly compacted or left uncompacted

- Identifying any material changes

Synthetic Materials

Geotextiles

During all geotextile placement, the CQA Team will perform the following:

- Verify that the subgrade has been prepared in accordance with the specifications
- Observe the geotextile as it is deployed and record all defects and disposition of the defects (panel rejected, patch installed)
- Mark the location of any defects requiring repairs and verify that all repairs have been made in accordance with the special provisions
- Verify that the geotextile is anchored to prevent movement by the wind
- Verify that joints are overlapped a minimum of 2 feet for nonwoven geotextile
- Verify that material anchorage is constructed as required by the project plans and special provisions
- Verify that geotextile is placed around the pea gravel in the collection trench, as shown on the plans
- Verify that cushion geotextile, if required, is placed above the geomembrane

Geomembrane

The Contractor will give each panel an identification that will be agreed to and used by the CQA Team, the Owner, and the Contractor. The CQA Team will establish a chart showing correspondence between roll numbers, certification reports, and panel numbers.

During geomembrane panel placement, the CQA Team will perform the following:

- Observe the geomembrane as it is deployed and record all panel defects and disposition of the defects (panel rejected, patch installed, extrudate placed over the defect)
- Verify that the single sided textured geomembrane is place with the texture side down
- Verify that equipment used does not damage the geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means
- Verify that the surface beneath the geomembrane has not deteriorated since previous acceptance and the surface is smooth and free of irregularities and desiccation cracking
- Verify that the Contractor has certified, in writing, acceptance of the surface on which the geomembrane is to be placed
- Verify that the method used to deploy the sheet minimizes wrinkles and that the sheets are anchored to prevent movement by the wind
- Mark the location of any defect requiring repairs and verify that all repairs are made in accordance with the project special provisions

- Collect geomembrane samples and record on the Geomembrane Sample Form
- Arrange for acceptance testing as required by this CQA Plan and the project special provisions
- Verify that geomembrane anchorage is constructed as required by the project plans and special provisions
- Maintain accurate records of geomembrane placement and testing

Geomembrane Seams

The Contractor will provide the CQA Team with a seam and panel layout drawing. A seam numbering system will be agreed to by the CQA Team, the Owner, and the Contractor prior to the start of seaming operations.

During seaming operations the CQA Team will perform the following:

- Verify that the Contractor has the number of seamers and spare parts agreed to in the preconstruction meeting
- Verify that equipment and personnel used for seaming are tested and qualified as required by project specifications and do not damage the geomembrane
- Observe and record all seaming and seam testing and verify that these activities are performed as required by the project special provisions
- Verify that repairs are made in accordance with the project special provisions
- Maintain accurate records of seaming and seam testing
- Verify that ambient weather conditions are acceptable for seaming operations

Post-Construction

Upon completion of the composite liner and LCRS, a post-construction inspection will be conducted by the Owner and CQA Team to check for material and placement imperfections in the installed materials and identify those areas that require corrective attention by the Contractor.

The Owner and CQA Team will inspect the liner and LCRS for the following:

- Low spots or depressions that would cause water to pond
- Areas that are damaged or improperly compacted
- Imperfections such as holes, rips, or creases that may jeopardize the integrity of the synthetic materials function
- Areas that have been excessively eroded by rainfall during construction or as a result of construction activities
- Irregularities or protrusions resulting from rocks, sticks, cracks, and excess material placement

- Damage to permanent structures in the vicinity of construction resulting from construction activities
- All required submittals and Record Drawings have been submitted and are in good order

Testing Program

A testing program will be implemented to verify that all components of the liner and LCRS are constructed in accordance with design specifications and plans and regulatory requirements. The Contractor, the Manufacturer, the Engineer, the CQA Team, or a qualified testing service under the observation of the CQA Team will conduct all tests. General test procedures and frequencies, as proposed for CQA inspection, are shown in Tables 1-3 (not all requirements may be applicable to this project). Documentation and reporting of test results will be in accordance with requirements described in the Documentation section of this CQA Plan.

The testing program is divided into material control and acceptance tests. The Contractor performs material control tests before construction to verify materials proposed for use will comply with the specifications. Acceptance tests are performed by the Contractor or CQA Team throughout construction of the liner and LCRS components to verify that the components are constructed in compliance with the project plans and specifications.

TABLE 1
Granular Drainage Material Control Testing

Test	Method	Recommended Frequency 1 Test Per Volume Shown	Required[a]/Recommended Minimum Criteria/ Specification	Proposed Frequency[b]	Proposed Criteria/ Specification
Particle Size	D422, D1140	1,500 cy	Maximum 3% pass No. 200 sieve	3,000 cy	1/2" max. particle size; <2% passing No. 200 sieve
Lab Permeability	D2434	3,000 cy	>0.1 cm/sec	3,000 cy	>0.3 cm/sec[c]
Soil Type	D2488, D2487	Continuous	GP	Continuous	Clean GP/SP/SW

[a]Required by SWRCB/CIWMB, Title 27, Division 2, Chapter 3.
[b]The proposed frequency corresponds to each material from each source. All sources will be tested at this frequency.
[c]Permeability may be calculated based on gradation test results using accepted engineering correlations rather than performing laboratory permeability tests.
Checklist prepared by Region 5-RWQCB (3/20/92) and modified from Table 10.1 of U.S. EPA Document EPA/600/2-88/052 (Lining of Waste Containment and Other Impoundment Facilities).

TABLE 2
Granular Drainage Material Acceptance Testing

Test	Method	Recommended Frequency 1 Test Per Volume Shown	Required[a]/ Recommended Minimum Criteria/ Specification	Proposed Frequency	Proposed Criteria/Specification
Particle Size	D422, D1140	1,500 cy	Maximum 3% pass No. 200 sieve	1,500 cy	1/2" max. particle size; <2% passing No. 200 sieve
Lab Permeability	ASTM D2434	3,000 cy	>0.1 cm/sec	3,000 cy	>0.3 cm/sec
Soil Type	D2488, D2487	Continuous	--	Continuous	Clean SP/SW or GP/GW

[a]Required by SWRCB/CIWMB, Title 27, Division 2, Chapter 3.
Checklist prepared by Region 5-RWQCB (3/20/92) and modified from Table 10.1 of U.S. EPA Document EPA/600/2-88/052 (Lining of Waste Containment and Other Impoundment Facilities).

TABLE 3
Test Methods

Test Type	Testing Method
Compaction (Modified Proctor)	ASTM D1557-78: Density relations of soils and soil-aggregate mixtures using 10.0 lb. (4.54-kg) hammer and 18-inch (457-mm) drop.
Particle Size	ASTM D422-63: Particle size analysis of soils.
	ASTM D1140-54: Amount of materials in soils finer than the No. 200 (75 µm) sieve.
Classification	ASTM D2487-85: Classification of soils for engineering purposes.
Atterberg Limit	ASTM D4318-84: Liquid limit, plastic limit, and plasticity index of soils.
Laboratory Permeability	ASTM D5084-90: Permeability of clay soils.
Moisture Content	ASTM D2216-80: Laboratory determination of water (moisture) content of soil.
	ASTM D4643: Determination of water (moisture) content of soil by the microwave method.
Field Description	ASTM D2488-84: Standard practice for description and identification of soils (visual-manual procedure).
Nuclear Density	ASTM D2922-81: Density of soil and soil aggregate in place by nuclear methods.
Field Density	ASTM D1556-82: Density of soil in place by the sand cone method.
	or
	ASTM D2167: Density of soil in place by the balloon method.
Lab Permeability (Granular)	ASTM D2434 Permeability of Granular Material (Constant Head).

Earth Materials Testing

The CQA team will perform the following duties and tests for earth materials:

- Determine the relative compaction and moisture content of the clay liner material and compare with established relationship between moisture content, dry density, and permeability.
- Require that the Contractor recompact areas where field density test results indicate that specified design requirements are not met, and then retest the soil for relative compaction.
- Select random testing locations for the soil components.
- Coordinate with soils testing laboratory to have appropriate laboratory tests performed. All testing shall be performed in accordance with the appropriate testing method as shown on Table 3.

Earth Material Control Tests

Earth material control testing will be performed by the Contractor with the results supplied to the CQA Officer for approval of the material. Earth material control tests and testing frequencies required for the LCRS are listed in Tables 1, 2, and 3 together with the RWQCB's recommended tests and frequencies. Earth material acceptance tests are to be performed on the granular drainage material. The proposed earth material control testing frequencies have been modified from RWQCB's recommended frequencies.

Earth Material Acceptance Tests

Acceptance tests and testing frequencies proposed for the granular drainage material are listed in the previous tables. Also listed in these tables are RWQCB's recommended tests and frequencies. The proposed acceptance testing program generally meets or exceeds RWQCB's recommended testing program. The project specifications clearly define the Contractor's responsibilities.

Synthetic Materials Testing

The CQA Team will perform the following duties and tests for the synthetic materials testing program:

- Review Contractor's submittals and certifications and compare with delivered products to check conformance with the submittals
- Review and approve the Contractor's results for subgrade to geomembrane interface testing as required by the project specifications
- Obtain samples and arrange for acceptance testing as described below
- Observe and record all geomembrane seam testing performed by Contractor and verify compliance with the project specifications

Synthetic Materials Control Tests

Geomembrane

The Contractor should provide to the Engineer sufficient materials to perform an interfacial shear test on the interface between the compacted subgrade, the textured HDPE geomembrane, and the nonwoven cushion geotextile (if used). Sufficient material should also be supplied to perform an interfacial shear test on the interface between the textured HDPE geomembrane and the subgrade. The Engineer will perform the interfacial friction test using a large box (12-inch by 12-inch) direct shear apparatus in accordance with ASTM D5321. When conducting the subgrade and textured HDPE geomembrane test, the geomembrane should also be oriented along the machine direction and the subgrade compacted to 90 percent relative compaction at approximately 2 percent above optimum moisture content (ASTM D1557).

The interfacial shear test performed by the Engineer will include a minimum of 3 points with the highest confining stress greater than 120 pounds per square inch. The test points should be performed at a strain rate of 0.03 inch per minute. The Engineer shall provide the results of the interfacial shear test to the CQA Team for review. The test results should comply with all the requirements, standards, and frequencies stated in the project specifications. Acceptance criteria and material specifications are defined in the project specifications.

Synthetic Materials Acceptance Testing

An approved third party laboratory will perform acceptance testing of geomembrane materials. The CQA Team will obtain samples of geomembrane for testing from rolls delivered to the site. Samples shall be taken across the entire roll width and shall not include the first 3 feet. Unless otherwise specified, samples shall be 3 feet long by the roll width. On each sample, the sampler shall mark the machine direction, the Manufacturer's roll identification number, and the date the sample was obtained. The required acceptance tests are listed in Table 4. The CQA Team will review all acceptance testing results to verify their conformance with the project specifications.

TABLE 4
Synthetic Materials Acceptance Testing

Material	Test Performed	Sampling Frequency	Purpose (units)	Required Value
HDPE Geomembrane	ASTM P1508	1 per 50,000 sf/ 1 per batch	Specify Gravity	min 0.94 g/cc
	ASTM D1603	1 per 50,000 sf/ 1 per batch	Carbon Black Content (%)	2-3
	ASTM D5596	1 per 50,000 sf/ 1 per batch	Carbon Black Dispersion	A1, A2, or B1
	ASTM D5994	1 per 50,000 sf/ 1 per batch	Thickness (MIL), not including texture	60 ± 10% with average > 60
	ASTM D638	1 per 50,000 sf/ 1 per batch	Tensile characteristics	>2,100 lbs @ >10%

Seams Testing

Geomembrane Seams

Geomembrane seams will be tested by the Contractor during installation. All seam testing will be performed concurrently with seaming operations, not at the completion of installation. Testing includes nondestructive and destructive tests outlined in Table 6. Testing and construction requirements are clearly defined in the project specifications.

TABLE 6
Field and Laboratory Testing of Seams

Material	Test Performed	Sample Frequency	Tests Per Sample	Purpose[a]
Geomembrane	Nondestructive Pressure Test: Geosynthetic Research Institute Test	Continuous	Continuous	Pressurized air channel test for hot wedge weld seam
	<u>Or</u>			
	Method GM-6			Single extrusion weld seam and/or when leak detected using pressure test
	Nondestructive Vacuum Box Test			
	Destructive Seam Test[b,c]:	500 feet	5	Peel
	ASTM D4437	minimum	5	Shear

[a]Required values and procedures are contained in the project specifications.
[b]Test seams will be made and tested at the beginning of each seaming period, every time the machine is reactivated or readjusted, at least once every 4 hours during continuous operation of each welding machine, and at the CQA Team's discretion. Each seamer will make at least one test seam per day.
[c]Destructive seam tests performed by Contractor in field with parallel third party laboratory testing performed by the CQA Team.

Additionally, the CQA Team will ship seam samples to a third party laboratory for destructive seam testing. The testing is performed at a frequency of one test for every 500 feet of seam length. These tests are performed to confirm the field destructive seam tests performed by the Contractor.

Nondestructive Seam Testing. During nondestructive seam testing operations, the duties of the CQA Team include the following:

- Observe and record all nondestructive testing performed by the Contractor on Geomembrane Vacuum Test Record and Seaming Record
- Record the location, date, test number, technician name, and results of all testing
- Mark any failed areas with a waterproof marker compatible with the liner (spray paint should not be used), and inform the Contractor and the CQA Officer of any required repairs
- Verify that all testing is completed in accordance with the project specifications
- Verify that all repairs are completed and tested in accordance with the project specifications

Destructive Seam Testing. Destructive seam testing will be performed by the Contractor in accordance with ASTM D4437 under the observation of the CQA Team. Sufficient samples will be collected by the Contractor to provide:

- One sample to the archive
- One sample to the CQA Team for laboratory testing
- Two samples to the Contractor for field testing

Each sample will be large enough to test five specimens for peel strength and five specimens for shear strength.

The Contractor will test samples in the field using a tensiometer capable of quantitatively measuring shear and peel strengths. If any sample fails, based on the requirements outlined in the specifications, the Contractor must retest samples 10 feet from the point of the failed test in each direction. If the second test passes, the Contractor will cap strip the seam between the two passed test locations. If subsequent tests fail, the testing will be repeated until the length of the poor-quality seam is established. Repeated failures indicate that either the seaming equipment and/or operator is not performing properly, and appropriate action should be taken.

During destructive testing, the CQA Team will perform the following:

- Identify to the Contractor locations to be sampled
- Observe sample cutting
- Mark each sample with an identifying number that contains the seam number
- Record sample location on the panel layout drawing
- Record the sample location, weather conditions, and reason sample was taken on the Geomembrane Field Strength Test Sheet form
- Request additional tests if the seam does not appear to meet specification requirements; for example, wrinkling in seam area, suspect seaming equipment, adverse weather conditions, dirt in the seam, and failing tests
- Locate and describe all seam and/or panel repairs on the Geomembrane Repair Form

Geotextile Seams

The responsibilities of the CQA Team regarding geotextile seams include the following:

- Verify that seams that are not sewn are overlapped a minimum of 24 inches
- Verify that the panels are being joined in accordance with the project plans and specifications
- Mark the location of any defects and inform the Contractor and the CQA Officer of any required repairs
- Verify that all repairs are completed in accordance with the project specifications and record on the Geotextile Repair Form

As-Built Surveying

To confirm required clay liner thickness and grades, the CQA Team will perform as-built surveying upon the completed subgrade and top-of-clay surfaces. The as-built surveys will provide coordinates and elevations at a minimum spacing of 75 feet and will be the basis for as-built plans to be included in the CQA Report. The Owner and Contractor will be responsible for all construction surveying and staking.

Action on Failing Tests

The results of all tests, whether laboratory or field, passing or failing, must be reported in the Daily Inspection Diary Sheets or other appropriate data sheets as provided in Appendix DA of this CQA Plan. Tests that do not meet the requirements of the specifications or this CQA Plan call for the following actions:

- Retests may be performed on the failed sample prior to taking corrective action.
- The area or volume of material represented by the failing test will be assessed so that appropriate remedial measures may be evaluated. If a design revision is required, the Engineer will be contacted. Additional tests will be used to define the affected area, as necessary.
- The Contractor's superintendent, the Owner, and the CQA Officer will be immediately advised of the failing test results.
- The CQA Officer will determine the appropriate corrective action and inform the Contractor and design engineer regarding said action. If the Contractor cannot correct the problem, the CQA Officer and design engineer will recommend alternative solutions to the Owner for approval.
- The required corrective action, the results of verification testing, and other documentation regarding the corrective action will be recorded.

Documentation

Daily Recordkeeping and Reporting

A Daily Inspection Diary will be kept with a record of any problems that occurred or corrective measures that were implemented throughout the day. All reports will bear identifying sheet numbers for cross-referencing and document control.

Daily Inspection Diary Sheets

All field observations and field testing will be recorded on the Daily Inspection Diary Sheets (Appendix DA). All field testing will follow ASTM standardized test procedures and methods of data recording or other test method described in the specifications. Observations in the field may be in the form of notes, charts, drawings or sketches, photographs, or any combination of the above. The Daily Inspection Diary Sheets will contain the following information where applicable:

- Date, name of project, and location
- Weather and site conditions
- Summary of any meetings conducted (other than formal periodic meetings), names of participants, and the results of the meetings
- Location of daily construction activities and progress
- Record of equipment and personnel working in a particular area
- Location of work being tested and areas passing final inspection
- Description and condition of any materials received at the site
- Record of equipment calibrations or recalibrations of test equipment and any actions taken as a result of recalibrations
- Site visits by others
- Identification of construction problems and their solution or disposition
- Description and title of specific inspection activities
- Time the activity was performed
- Location of the inspection activity
- Standard test method used or type of inspection activity
- Test equipment used, and calibrations, if applicable
- Record of observation and test data, with all calculations completed and checked

- Construction methods and equipment origin material and general description of conditions
- Comparison of test results and observations with specification requirements
- Names and titles of all persons involved in inspection activity
- Record of materials and workmanship that do not meet specified design and corrective action measures taken
- Signature of appropriate CQA inspection personnel

Monthly Construction Summaries

The Monthly Construction Summary will be prepared by the CQA Officer and will include the following items:

- Inspection dates
- Time spent on the site
- Activities performed
- Test performed
- Specified locations inspected
- Summary of the completed Daily Inspection Diary Sheets
- Signature of the CQA Officer

Acceptance of Completed Components

The liner and LCRS will be approved by CQA personnel when:

- The installation is finished and in accordance with all requirements of the project plans, specifications, and this CQA Plan
- Repairs are complete
- The owner has received documentation for the installation from the Engineer or CQA Team

Daily Inspection Diary Sheets, monthly construction summaries, inspection photographs, and test results will be reviewed by the CQA Officer. Reports will be evaluated for internal consistency, accuracy, and completeness. These reports will be reviewed in a timely manner.

The daily reports will be summarized into periodic acceptance reports. The reports will indicate that work has been completed and approved according to the specified design. These reports will be included in the project files and available to the appropriate regulatory agencies.

Document Control and Storage

During construction, the CQA Officer will be responsible for all CQA documents and organization of the documents for easy access. The CQA Officer will be responsible for keeping duplicate records for all documentation at another location. The CQA Officer will be responsible for incorporating any revisions to the CQA Plan and distributing revised copies to the Contractor and all other relevant parties.

Upon completion of the liner and LCRS construction, The CQA Team will store all original documents and a copy of the final CQA Report will be maintained at the landfill by the Owner. These documents will be stored so that they are protected from damage, yet accessed easily. All documentation will be maintained through the postclosure monitoring periods of the facility.

Final CQA Report

At the completion of the project, a final CQA report, including as-built drawings, will be prepared and sent to the Owner for transmittal to RWQCB. This report will include all documentation necessary to demonstrate that construction proceeded in accordance with the intent of the construction plans, specifications, and CQA Plan. Because there are often revisions to the design during construction, as-built drawings will be prepared to represent the constructed facility. The as-built drawings will include drawings showing the surveys of subgrade, top of clay, and leachate collection pipe alignment and revisions to the design plans and details. The final CQA report will be stamped by the CQA Officer who will be a registered civil engineer or certified engineering geologist in the State of California.

SECTION 01400

QUALITY CONTROL PROGRAM REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Parts and components produced and the services provided in fulfilling the requirements of the Buyer's Specification shall be performed in accordance with the requirements of the Seller's Quality Control Program. As a minimum, the Seller's Quality Control Program shall meet the requirements of ASQC Standard C1-1985 (ANSI STD Z1.8), Specification of General Requirements for a Quality Program. Seller's Quality Control Program shall be documented in sufficient detail to assure that the Buyer's requirements will be met during the design, procurement, assembly, installation, inspection and testing of the materials and components. Similar controls, as applicable to the scope of work, shall be imposed on the Seller's subcontractors and suppliers.

1.02 SELLER'S INTEGRATED MANUFACTURING INSPECTION AND TEST PLAN (ITP)

A. Seller shall prepare an ITP consistent with the requirements of the Buyer's Specification and the Seller's Quality Control Program. The ITP shall sequentially list all major manufacturing operations, applicable inspections and tests, and related Seller's special process, inspection and test procedures (by title) and the acceptance/rejection criteria for each inspection or test.

B. The ITP will be reviewed by the Buyer for the purpose of selecting Buyer Witness Points. Once Buyer Witness Points are identified, a ten-day notice is required for all impending Buyer Witness Points. Buyer shall have full access to the Sellers and the sub-vendor facilities for the purpose of inspection, surveillance or quality auditing.

C. Seller shall maintain a current list of inspection personnel qualification. The list shall identify the inspector's name, discipline, level of certification, and expiration date.

D. Individuals assigned to perform inspection shall not have performed the work being inspected, nor shall they report directly to the immediate supervisor who is responsible for the work inspected.

1.03 NONCONFORMANCE

A. Major deviations from the requirements of the Design Documents shall be reported in writing to the Buyer. Deviations dispositioned as Repair/Rework or Use As Is shall require approval or concurrence by the Buyer prior to proceeding further with the work.

B. Modifications, repairs, rework, or replacements performed subsequent to final inspections shall require re-inspection or retest to verify acceptability.

1.04 SELLER SUBMITTALS

A. With Bid

1. A descriptive summary of the Seller's Quality Control Program and a statement as to which Industry Quality Standard it is intended to comply with.

B. After Award

1. No later than thirty days after Award, the following Seller documents/procedures shall be submitted:

- Integrated Manufacturing, Inspection and Test Plan
- Special Process Procedures
- Test Procedures

C. At Delivery

1. No later than one (1) week after delivery, three (3) copies of Quality Control documentation shall be provided to the Buyer including, as appropriate to the order:

- Material Certifications required by code
- NDE Reports
- Test Reports
- Nonconformance Reports
- Pressure Test Reports
- Performance Test Reports

END OF SECTION

SECTION 02776

HDPE POND LINER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation, the HDPE pond liner and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED SECTIONS

A. Related sections include, but are not limited to, the sections listed below.

1. Section 01300, Submittals
2. Section 01400, Quality Control
3. Section 01600, Material and Equipment

1.03 SUBMITTALS

A. Submit the following Product Data in accordance with Section 01300, Submittals for 60 mil textured HDPE: Testing frequency shall be in accordance with Geosynthetic Research Institute (GRI) GM 13 Standards.

1. Material Data including:

			Minimum Values
a.	Thickness (60 mil)	ASTMD 5994.	54 mil
b.	Density	ASTM-D 1505	0.940 g/cc
c.	Tensile Properties	ASTM-D 638,	
	Yield Stress	Type IV @ 2 ipm	132 lb/in
	Break Stress	G.L. per NSF 54	220 lb/in
	Yield Elongation	(1.3" G.L.)	13 %
	Break Elongation	(2.0" G.L.)	100 %
d.	Tear Resistance	ASTM-D 1004	44 lb
e.	Puncture Resistance	ASTM 4833	108 lb
f.	Carbon Black Content	ASTM-D 1603.	2 - 3 %

g.	Carbon Black Dispersion	A1, A2, B1 ASTM-D 5596	Cat. 1 or 2
h.	Resin Properties		
	Density	ASTM D 1505	>0.932 gm/cm3
	Melt Flow Index	ASTM D 1238	< 1.0 gram/10 min

2. Shop Drawings

   a. Arrangement and sequence of placing panels.

   b. Location of field seams.

3. Samples

   a. Liner material (6" x 6" minimum).

   b. Liner material with field seam.

   c. Geotextile.

4. References from last 5 projects stating the Owner, location, dates, and square footage.

5. Installer's procedures and QA/QC documentation for trial test seams, field seaming, destructive sampling, and patching.

6. Resumes for project superintendent, QC technician, and seamers, include square footages and mil thickness. QC technician must include demonstrated training and experience in field testing of geosynthetic materials.

7. Manufacturing, fabrication, delivery, and installation schedules.

8. Warranty information.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Ship material in rolls with no creases.

B. Material received at jobsite will be inspected and damaged material will be returned to the manufacturer.

C. Material shall be stored in accordance with Manufacture's recommendations.

D. Roll leftover material of useable size into manageable bundle and deliver to Owner appointed site.

1.05 SITE CONDITIONS

A. Installer to supply own electrical needs including portable generators, lights, etc.

B. Installer to supply own tools and equipment.

C. Installer to supply equipment necessary to work at night if scheduling conditions or weather conditions dictate.

D. Installer to assume responsibility for damages incurred during liner installation such as excessive wind, flood, tornado, fire, or other natural disaster.

1.06 INSTALLER QUALIFICATIONS

A. Minimum of 5 years of previous experience in the installation of HDPE liner systems.

B. Installer shall have installed a minimum of 8,000,000 square feet of 60-mil or thicker HDPE liner.

1.07 EQUIPMENT AND ACCESSORIES

A. Welding Equipment

1. The Installer shall provide welding equipment equipped with gauges showing temperature at the nozzle (extrusion welder) or at the wedge (wedge welder).

2. Equipment shall be maintained in adequate number and condition to avoid delaying work, and shall be supplied by a power source capable of providing constant voltage under a combined-line load. Electric generators shall not be placed on the membrane.

B. Field Tensionmeter

1. The Installer shall provide a tensionmeter for on-site shear and peel testing of geomembrane seams. The tensionmeter shall be in good working order, built to ASTM and/or GRI specifications, and accompanied by evidence of recent calibration.

2. The tensionmeter shall be motor driven and have jaws capable of traveling a measure rate of two inches (2") per minute. It shall be equipped with a gauge that measures the force in unit pounds exerted between the jaws and have digital readout.

C. Punch Press

1. The Installer shall provide a punch press for the on-site preparation of specimens for testing.

2. The press shall be capable of cutting specimens in accordance with ASTM-D 4437.

D. Vacuum Box

1. The Installer shall provide a vacuum box for on-site testing of geomembrane seams.

2. The vacuum box shall have a transparent viewing window on top and a soft, close-cell neoprene gasket attached to the bottom.

3. The housing shall be rigid and equipped with a bleed valve and vacuum gauge.

4. A separate vacuum source shall be connected to the vacuum box.

5. The equipment shall be capable of inducing and holding a minimum vacuum of three (3) psi.

E. Pressurized Air Channel Test Equipment

1. The Installer shall provide a hand-held heat device necessary to seal the two ends of the air channel and wide mouth vice grips to further lock-off these sealed ends.

2. The sharp, hollow needle with a properly functioning pressure gauge will be necessary to insert air into the open channel and monitor its pressure.

3. An air pump, either manual or motor driven, capable of generating and sustaining up to 350 kPa (50 psi) pressure will also be required. Always place this equipment on an adequate cushion so as not to damage the geomembrane.

4. A flexible hose shall be used to connect the pump to the air pressure gauge and insertion needle.

5. The flexible hose shall have a quick connect on its end for disengagement after pressure is supplied to its desired value, i.e., and the pump is not to be attached while the air pressure is being monitored.

6. A knife with a hook type blade must be available in the event that the liner material must be cut or trimmed.

1.08 WARRANTY

A. Provide written warranty for 5 years life signed by Installer and 20 years life signed by the Manufacturer.

B. Warranty will cover replacement and/or repair from:

1. Defective materials.

2. Defective workmanship.

3. Significant leakage.

4. Abnormal aging or deterioration.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. GSE Lining Technology, Inc.

B. Poly-Flex

C. Or equal

2.02 MATERIALS

A. 60 mil textured High Density Polyethylene (HDPE). Color: Black.

1. Use only first quality resins manufactured by Mobil, Phillips, or equal.

2. No fillers may be added to the resin prior to or during manufacture of the geomembrane.

3. Boots for Piping: Black 60 mil HDPE.

B. 6-inch wide HDPE attachment strip, for concrete embedment.

C. Geotextile:

Geotextile shall be of nonwoven construction, with polypropylene continuous filaments thermally bonded. The geotextile shall be Geotex 1001 (1001 gr/cm2) as manufactured by SI Geosolutions, or equivalent. The geotextile shall be used to separate the secondary 60-mil HDPE liner from the pond subgrade and to wrap the drainage aggregate in the leachate pipe collection trench and the Vadose monitoring system.

D. Geonet with 6 oz/sy Geotextile Bonded to Both Sides:

Geonet composite shall be GSE TP275-66, high-flow capacity Tri-planar geonet core with a6 oz/sy geotextile heat bonded to both sides, as manufactured by GSE Lining Technology, Inc. or equivalent. The geonet composite shall be installed between the primary and secondary liners to collect Leachate and convey it to the Leachate collection and removal system.

PART 3 EXECUTION

1. EXAMINATION

2. Verify that pond elevations and grades are correct before liner placement.

3. Verify depth and location of leak detection and anchor trenches.

4. PREPARATION

5. Provide sandbag weights to secure liner during installation.

6. INSTALLATION

7. HDPE

8. Materials laid out must be completely seamed during that workday.

9. Run field seams perpendicular to toe of slope.

10. Lap field seams a minimum of four inches and a maximum of six inches.

11. Clean liner areas at seams before welding.

12. Do not seam wet liner material.

13. Patch areas showing fish mouths, improper bonding, scuffed surfaces, holes or distress with an additional layer of same liner material.

14. Trenches

15. Dig anchor trenches just prior to liner installation.

16. Install anchor trenches per details on drawings.

17. Verify buried depth of liner in trench.

18. Backfill anchor trenches and compact to a minimum 90% modified Proctor density.

C. Geotextile and Geonet Composite:

Install in accordance with the manufaturers' installation instructions.

3.04 QUALITY ASSURANCE

A. Installer must provide written certification by the manufacturer stating that he is an approved installer.

B. Test seams shall be made to verify that adequate conditions exist for field seaming to proceed. Each seamer shall produce a test seam at the beginning of each shift to determine peel and tensile strength of the seam.

C. Extrusion/seaming machines shall be operated by Manufacturer approved personnel only.

3.05 FIELD QUALITY CONTROL

A. Manufacturer shall provide an experienced field inspector to supervise liner installation.

B. Installer shall coordinate installation with Manufacturer's field inspector and Project Representative. Inspections will be conducted concurrently in a timely manner to expedite installation.

C. Liner placement, seaming techniques, testing and all other work will be observed by Installer, Manufacturer's inspector and Project Representative from the beginning of the installation. Changes in procedure required by these parties will be implemented immediately.

D. Perform leak tests on all field seams. Installer shall run tests, Manufacturer's inspector and Project Representative to oversee testing.

E. 100% of double wedge Fusion seams shall be air pressure tested at 30 psi for 5 minutes with no more than 4-psi drop in pressure. 100% of Extrusion welded seams shall be vacuum tested at -3 psi for 10 seconds. All failures shall be repaired and retested.

F. All Field seams shall have a field tear bond (FTB) in peel and shear testing. Peel adhesion strength tests are acceptable when strength exceeds 62% of the liner material strength. Shear strength tests are acceptable when strength exceeds 95% of liner strength. This destructive testing shall occur once for every 500 linear feet of field seam, with a sample taken out of material in the anchor trench. Destructed area shall be patched with same material and extrusion welded.

G. All parties must inspect and approve leak detection piping and trenches.

H. All parties must inspect and approve pipe boots.

I. Repair all defects found by inspections.

J. Repair damages to pond liner resulting from installation or inspection.

END OF SECTION

SECTION 02777

CONCRETE EROSION CONTROL REVETMENT LINER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish and install Uniform Section Mat (USM) and Filterpoint (FP) Concrete Erosion Control Revetment

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control

B Section 01410 – Testing Laboratory Services

C. Section 02320 - Backfill

D. Section 02371 – Riprap and Rock Lining

E. Section 02776 – HDPE Pond Liner

F. Section 03300 – Cast-In-Place Concrete

1.03 REFERENCES

A. ASTM C 31, - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

B. ASTM C 33, - Standard Specification for Concrete Aggregates.

C. ASTM C 39, - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

D. ASTM C 150, - Standard Specification for Portland Cement.

E. ASTM C 260, - Standard Specification for Air-Entraining Admixtures for Concrete.

F. ASTM C 494, - Standard Specification for Chemical Admixtures for Concrete.

G. ASTM C 618, - Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

H. ASTM D 737, - Test Method for Air Permeability of Textile Fabrics.

I. ASTM D 1117, - Methods of Testing Nonwoven Fabrics.

J. ASTM D 1682, - Test Methods for Breaking Load and Elongation of Textile Fabrics.

K. ASTM D 1777, - Methods of Testing Nonwoven Fabrics.

L. ASTM D 2256, - Standard Method for Breaking Load (Strength) and Elongation of Yarn by the Single-Stand Method.

M. ASTM D 3776, - Standard Test Methods for Mass per Unit Area (Weight) of Woven Fabric.

N. ASTM D 3786, - Standard Test method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.

O. ASTM D 3787, - Standard Test Method for Bursting Strength of Knitted Goods: Constant-Rate-of Transverse (CRT), Ball Burst Test.

P. ASTM D 4491, - Standard Test Methods for Water Permeability of Geotextile by Permittivity.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Concrete: Design mix and compressive strength test results.

C. Fabric Forms: Manufacturer's certified test results.

D. Shop Drawings for Concrete Erosion Control Revetment Liner

PART 2 PRODUCTS

2.01 FINE AGGREGATE CONCRETE

A. Fine aggregate concrete shall consist of a mixture of Portland cement, fly ash, fine aggregate (sand), and water so proportioned and mixed as to provide a pumpable product. Fluidifier confirming to these Specifications may be used at the option of the Contractor. The mix shall exhibit a minimum compressive strength of 2500 psi at 28 days when made and tested in accordance with ASTM C 31 and ASTM C 39. The mix shall be designed by the Contractor.

1. Portland cement shall conform to ASTM C 150, Type II.

2. Fine aggregate shall conform to ASTM C 33, except as to grading. Aggregate grading shall be reasonably consistent and shall be well graded from the maximum size, which can be conveniently handled with available pumping equipment.

3. Water for mixing shall be clean and free from injurious amounts of oil, acid, salt, alkali, organic matter or other deleterious substances.

4. Fly ash shall conform to ASTM C 618 and be Class C or F fly ash. Fly ash may be used as a substitute for up to 25% of the cement.

5. Fluidifier, if used, shall be a super-plasticizer agent conforming to ASTM C 494. The fluidifier shall serve the purpose of causing more efficient hydration of cement with the resulting higher strength.

6. Air-entraining admixtures shall conform to the requirements of ASTM C 260.

7. Calcium chloride or admixtures (except fly ash) containing more than trace amounts of calcium chloride, chlorides, sulfides, or nitrates shall not be used.

2.02 FABRIC FORMS

A. The fabric forms shall be ARMORFORM as manufactured by Nicolon Corporation; or Fabriform as manufactured by Construction Techniques, Inc.; or approved equal. Each layer of fabric shall meet or exceed the statistical mean (average) results as shown on the following table.

PROPERTY	TEST METHOD	UNIT	VALUES
Physical:			
Composition	-	-	Polypropylene
Weight (double layer)	ASTM D 3776	oz/yd	10
Thickness	ASTM D 1777	mils	20
Mill Width	-	inches	84 to 172
Mechanical:			
Grab Tensile Strength – Warp	ASTM D 1682	lb	200
Grab Tensile Strength – Fill	ASTM D 1682	lb	200
Grab Tensile Elongation	ASTM D 1682	%	20
Diaphragm Burst Strength	ASTM D 3786	psi	475
Trapezoidal Tear Strength - Warp	ASTM D 1117	lb	65
Trapezoidal Tear Strength - Fill	ASTM D 1117	lb	75
Puncture Strength	ASTM D 3787	lb	60
Hydraulic:			
Water Flow Rate	ASTM D 4491	gal/min/sf	80
Permeability (k)	ASTM D 4491	cm/sec	0.05
Permittivity (k/l)	ASTM D 4491	1/sec	1.0
Porosity	ASTM D 737	cf/min/sf	125
Spacer Cord:			
Break Strength	ASTM D 2556	lbs/cord	135

The Contractor shall furnish manufacturer's certified test results showing actual test values obtained when the above physical properties were tested for compliance with the Specifications.

B. Fabric form material shall consist of double-layer woven fabric jointed together by spacer cords, of uniform length, to produce a mat with finished nominal thickness as shown on the Drawings. Points of connection shall be staggered to provide a bonded, cobbled, surface appearance.

C. Individual mill width rolls of fabric form shall be minimum width of 84 inches. Mill width rolls shall be cut to the length required, and the two layers of fabric separately joined, bottom edge to bottom edge and top edge to top edge by means of sewing thread, to form multiple mill width panels. All factory-sewn seams shall be downward facing. The grab tensile strength of all sewn seams shall not be less than 100 lb/in. when tested in accordance with ASTM D 1682.

D. Stops shall be installed at predetermined mill width intervals in order to regulate the flow of fine aggregate concrete.

E. Immediately following receipt of fabric forms at the jobsite, forms should be inspected and stored in a clean dry area where they will not be subject to mechanical damage, exposure to moisture, or direct sunlight.

2.03 SHOP DRAWINGS

A. Shop drawings of the materials, equipment, method of installation, installation details for the complete system, and manufacturer's product literature and specifications for this installation shall be submitted prior to start to the concrete erosion control revetment liner installation for Owner review and acceptance.

PART 3 EXECUTION

3.01 SITE PREPARATION

A. Areas on which fabric forms are to be placed shall be constructed to the lines and grades shown on the Drawings.

B. Excavation and preparation of anchor trenches, terminal trenches, and lap joint trenches shall be done in accordance with the lines, grades, and dimensions shown on the Drawings.

C. Immediately prior to placing the fabric forms, the prepared area shall be inspected by the Owner and no forms shall be placed thereon, until the area has been approved.

3.02 FABRIC FORM PLACEMENT

A. Fabric form panels shall be placed within the limits shown on the Drawings.

B. Adjacent fabric form panels shall be joined before fine aggregate concrete injection, by field sewing or zippering the two bottom layers of fabric together and the two top layers of fabric together. All sewn seams shall be downward facing.

C. When conventional joining of panels is impractical, or where called for on Drawings, adjacent panels may be overlapped a minimum of three feet pending approval by the Owner. In no case shall simple butt joints between panels be permitted.

D. Lap joints and expansion joints shall be provided as required.

E. Immediately prior to injection of fine aggregate concrete, the assembled fabric form panels shall be inspected by the Owner and no fine aggregate concrete shall be pumped therein until the fabric seams, panel connections, and anchor system have been approved.

F. No joints shall be placed within channel bends or within 15 feet upstream or downstream of channel bends, or at other locations where the joint may effect the water flow characteristics.

G. Channel joints shall not result in upstream ponding of water.

3.03 FINE AGGREGATE CONCRETE PLACEMENT

A. Following panel placement, small slits shall be cut in the top layer of the fabric form to allow for the insertion of the injection pipe. Fine aggregate concrete shall be injected between the top and bottom layers of fabric, filling the panel to the required thickness and configuration.

B. Fine aggregate concrete shall be injected in such a way that excessive pressure on the fabric form and cold joints are avoided.

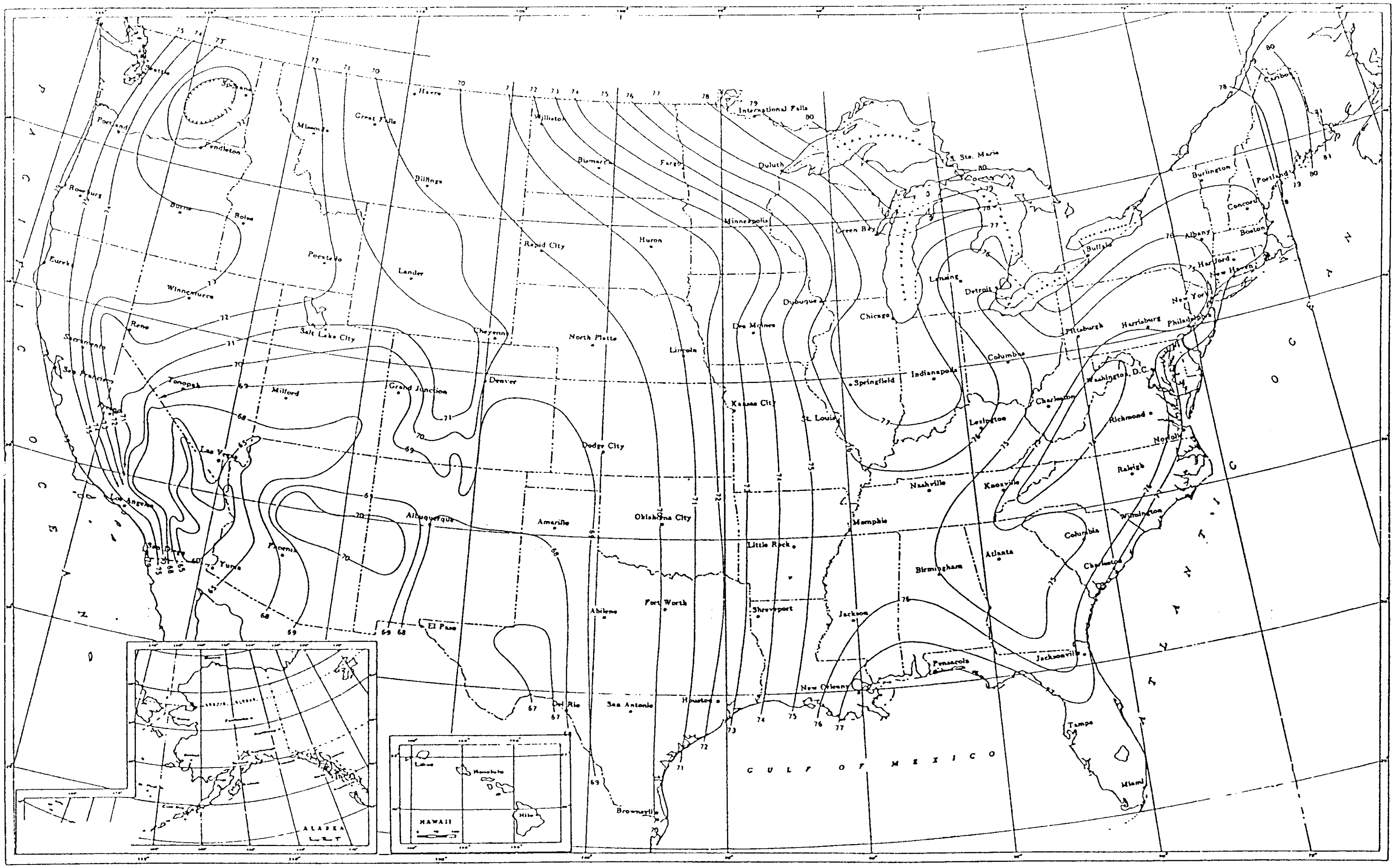
C Holes in the fabric left by the removal of the injection pipe shall be temporarily closed by inserting a piece of burlap or similar material. The burlap shall be removed when the concrete is no longer fluid and the concrete surface at the hole smoothed by hand. Foot traffic on the filled mat shall be restricted to an absolute minimum for one hour after pumping.

D. Upon completion of fine aggregate concrete placement, all anchor trenches shall be backfilled as shown on the Drawings.

END OF SECTION

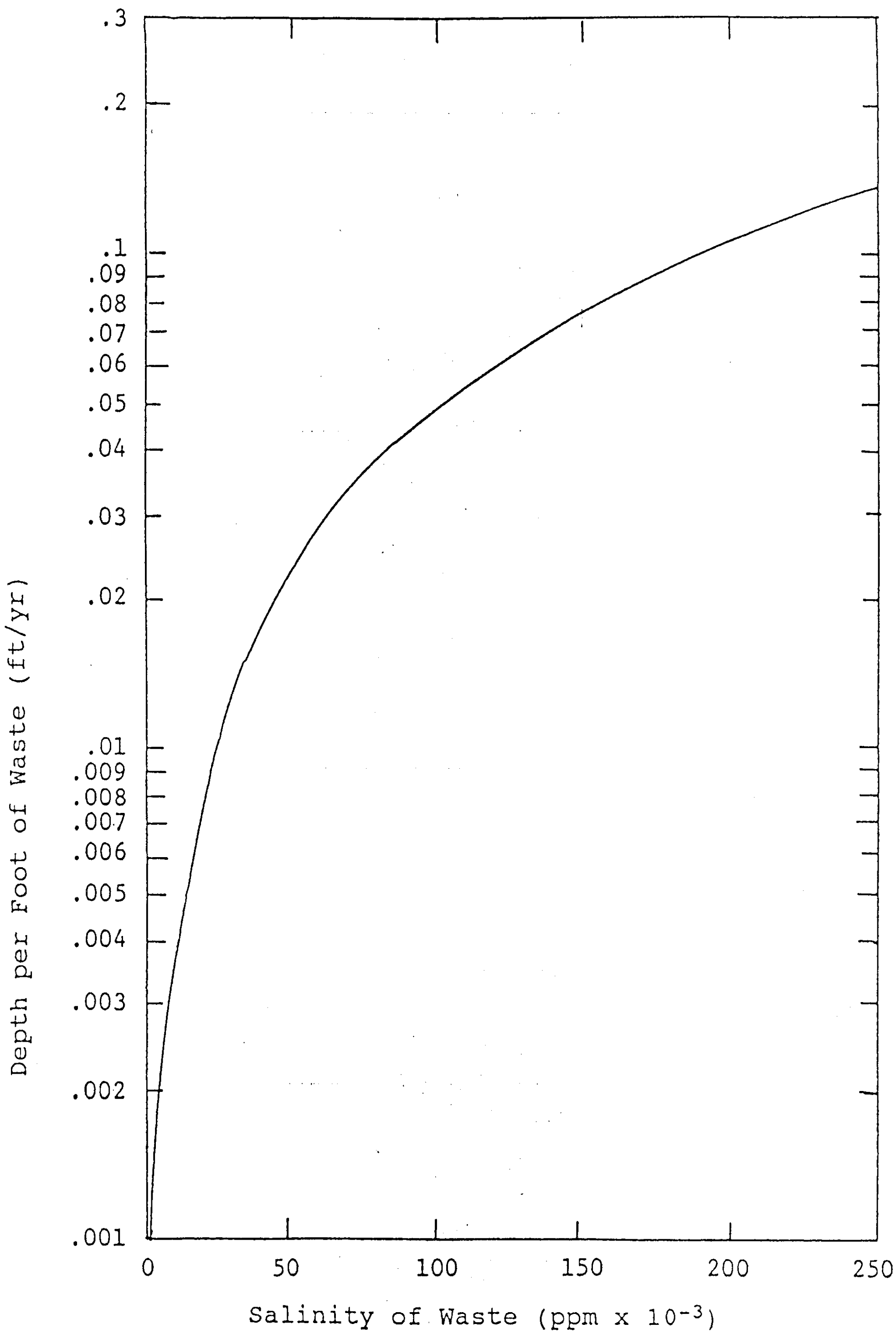
APPENDIX B

Engineering Calculations for Determination of Pond Capacity and Depth



Source: USDC 1968

FIGURE B-1
Mean Annual Class A Pan Coefficients, 1946-1955



Source: USDI, Office of Saline Water 1970

FIGURE B-2
Depth of Precipitate in an Evaporation Pond

EAEC Evaporation Pond Calculations

Brine Discharge Volume

100% BBID Raw Water

While operating on 100% BBID raw water, the corresponding concentrated brine flowrates from the project water balances are as follows:

Peak Operation – 7 gpm
Base Operation - 5 gpm

On an annual basis, assuming the operation profile shown in Table B-1, the total annual concentrated brine volume is:

Total Annual Concentrated Brine - 7.7 acre-feet

100% Recycled Water

While operating on 100% recycled water, the corresponding concentrated brine flowrates from the project water balances are as follows:

Peak Operation – 53 gpm
Base Operation - 20 gpm

On an annual basis, assuming the operation profile shown in Table B-2, the total annual concentrated brine volume is:

Total Annual Concentrated Brine - 34.9 acre-feet

Blended Water

Table 7-1A of the Application for Certification (AFC) submitted to the California Energy Commission indicates that in Year 1, the source of water to the EAEC will be 100-percent BBID raw water. Table 7-1B of the AFC projects that in Year 20, approximately 62-percent of the project's water needs could potentially be met through the use of recycled water from the Mountain House Community Services District's wastewater treatment plant (Tables 7-1A and 7-1B are included as Exhibit B-1, located at the end of this appendix. As indicated above, the use of recycled water results in a greater production of concentrated brine. To be conservative, the worst case total annual concentrated brine volume will be based on that projected to be produced in Year 20, calculated as follows:

Total Annual Concentrated Brine= (38%)(7.7) + (62%)(34.9)

= 25.4 acre-feet

TABLE B-1
Projected Water and Brine Flows – 100% BBID Raw Water

Raw Water				
Peak Day	6,322	gpm	9.1	mgd
Average Day	2,772	gpm	4.0	mgd
Recycled Water				
Peak Day	0	gpm	0.0	mgd
Average Day	0	gpm	0.0	mgd
Concentrated Brine Waste				
Peak Day	7.2	gpm		
Average Day	5.3	gpm		

					Raw Water		**Recycled Water**		**Concentrated Brine**	
Month	**Days/ Month**	**Capacity**	**Hours/Day at Peak Demand**	**Days/Week at Peak Demand**	**Average Demand (mgd)**	**Monthly Demand (acre-ft)**	**Average Demand (mgd)**	**Monthly Demand (acre-ft)**	**Average Flow (gpm)**	**Monthly Flow (acre-ft)**
January	31	80%	0	0	3.2	304	-	-	4.2	0.6
February	28	80%	0	0	3.2	274	-	-	4.2	0.5
March	31	80%	0	0	3.2	304	-	-	4.2	0.6
April	30	80%	0	0	3.2	294	-	-	4.2	0.6
May	31	80%	0	0	3.2	304	-	-	4.2	0.6
June	30	95%	12	6	5.9	541	-	-	5.8	0.8
July	31	95%	12	6	5.9	559	-	-	5.8	0.8
August	31	95%	12	6	5.9	559	-	-	5.8	0.8
September	30	95%	12	6	5.9	541	-	-	5.8	0.8
October	31	80%	0	0	3.2	304	-	-	4.2	0.6
November	30	80%	0	0	3.2	294	-	-	4.2	0.6
December	31	80%	0	0	3.2	304	-	-	4.2	0.6
Total	**365**	**85%**			**4.1**	**4,580**	**-**	**-**	**4.8**	**7.7**

TABLE B-2
Projected Water and Brine Flows – 100% Recycled Water[1]

Raw Water				
Peak Day	88	gpm	0.1	mgd
Average Day	0	gpm	0.0	mgd
Recycled Water				
Peak Day	6,283	gpm	9.0	mgd
Average Day	2,788	gpm	4.0	mgd
Concentrated Brine Waste				
Peak Day	53.5	gpm		
Average Day	20.1	gpm		

					Raw Water		**Recycled Water**		**Concentrated Brine**	
Month	**Days/ Month**	**Capacity**	**Hours/Day at Peak Demand**	**Days/Week at Peak Demand**	**Average Demand (mgd)**	**Monthly Demand (acre-ft)**	**Average Demand (mgd)**	**Monthly Demand (acre-ft)**	**Average Flow (gpm)**	**Monthly Flow (acre-ft)**
January	31	80%	0	0	-	-	3.2	306	16.1	2.2
February	28	80%	0	0	-	-	3.2	276	16.1	2.0
March	31	80%	0	0	-	-	3.2	306	16.1	2.2
April	30	80%	0	0	-	-	3.2	296	16.1	2.1
May	31	80%	0	0	-	-	3.2	306	16.1	2.2
June	30	95%	12	6	0.1	5	5.9	540	32.7	4.3
July	31	95%	12	6	0.1	5	5.9	558	32.7	4.5
August	31	95%	12	6	0.1	5	5.9	558	32.7	4.5
September	30	95%	12	6	0.1	5	5.9	540	32.7	4.3
October	31	80%	0	0	-	-	3.2	306	16.1	2.2
November	30	80%	0	0	-	-	3.2	296	16.1	2.1
December	31	80%	0	0	-	-	3.2	306	16.1	2.2
Total	**365**	**85%**			**0.0**	**19**	**4.1**	**4,590**	**21.6**	**34.9**

1 – 100% recycled water is used for cooling tower makeup. During peak operation, BBID raw water is used for supplemental makeup to the demineralized water system .

Required Pond Area

Net Annual Evaporation Rate

The mean annual Class A pan evaporation at the Tracy Pumping Plant (approximately ½-mile west of the project site) per State of California, Department of Water Resources records from 1955 through 1999 (see Table 4-3) is:

Mean Annual Class A Pan Evaporation Rate = 96.5 inches

Experience has shown that large bodies of water exhibit lower evaporation rates than that measured in a Class A pan. To be conservative, it is assumed that the evaporation pond performance will more closely reflect that of a large body of water. Factors have been developed for calculating the evaporation for a shallow lake or reservoir from the Class A pan evaporation rate (see Figure B-1, United States Department of Commerce). Based on this information, a factor of 0.75 is assumed and the mean annual lake evaporation rate is calculated as follows:

Mean Annual Lake Evaporation Rate = (0.75)(96.5)
= 72.4 inches

In addition, salinity can significantly reduce the rate of evaporation. In the absence of site-specific data, a factor of 0.70 is commonly used to provide a reasonable allowance for the effect of salinity. Thus, the design evaporation rate is calculated as follows:

Mean Annual Evaporation Rate (including the effects of salinity) = (0.70)(72.4)

= 50.7 inches

To determine the net annual evaporation rate, the annual precipitation must be subtracted from the gross evaporation rate:

Net Annual Evaporation Rate = 50.7 – 11.9

= 38.8 inches

Pond Area

In order to allow for unpredictable circumstances, design contingencies are applied to the amount of concentrated brine to be discharged to the evaporation pond. Operating experience at other industrial evaporation ponds has shown that the discharges are the largest during the first year of operation , are reduced during the second year, and are relatively constant thereafter (Mickeley, Hamilton, Gallengos, and Truesdall). The following contingencies have been assumed for the EAEC:

- 50 percent of discharge flow during the first year of operation
- 30 percent of discharge flow during the second year of operation
- 20 percent of discharge flow thereafter

The total flow discharged into the evaporation pond will be averaged over the life of the project for the purpose of determining the evaporation pond area. In other words, a portion of the added flow discharged during the first two years of operation will be evaporated during later years. Since there will be very little sludge accumulated in the bottom of the pond during the early years, additional depth will be available for storage of the excess brine. In addition, since the source water during the early years will be primarily BBID raw water, the brine discharge volume will actually be much less than that assumed. The design average annual concentrated brine flow over the first 30 years of the project is calculated as follows:

$$\text{Design Average Annual Concentrated Brine Flow} = \frac{1.50 + 1.30 + (1.20)(28)}{30} \times 25.4$$

$$= 30.8 \text{ acre-feet}$$

The required total pond area can be calculated by dividing the design annual concentrated brine flow by the net annual evaporation rate:

$$\text{Required Total Pond Area} = \frac{(30.8)(12)}{38.8}$$

$$= 9.5 \text{ acres}$$

The required pond area will be conservatively based on the area measured at the toe of the inside face of the pond dike. Since the pond dike will be constructed with a 3:1 horizontal to vertical side slope, as the pond fills with brine, the area available for evaporation will increase. Two ponds, each designed for approximately 50% of the total required area will be provided. Thus, the minimum area of each pond is:

$$\text{Required Minimum Area, each pond} = (50\%)(9.5)$$

$$= 4.75 \text{ acres}$$

Assume use of two nominal 5-acre evaporation ponds, thus providing a total of 10 acres of evaporation area.

Evaporation Pond Depth

Each evaporation pond will be designed for a minimum depth of 10.0 feet, measured from the toe of the inside face of the dike to the top of the dike at the pond edge. For simplicity, the additional depth provided as a result of the sloping pond bottom will not be considered in evaluating the adequacy of pond volume, thus providing additional conservatism.

Freeboard

Wave Height

Freeboard for wave action can be estimated using the following equation (United States Department of Interior (USDI), Office of Saline Water 1970):

$$H_w = 0.047\, W\, (F)^{1/2}$$

Where:
H_w = wave height (ft)
W = wind velocity (mph)
F = fetch, or longest dimension of pond (miles)

For the EAEC, the maximum wave height is calculated as follows:

$$H_w = (0.047)(50)(750 / 5{,}280)^{1/2}$$
$$= 0.89 \text{ feet}$$

Run-up of the waves on the face of the dike approaches the velocity head and can be approximated as:

$$\text{Wave Runup} = 1.5\ H_w$$
$$= (1.5)(0.89)$$
$$= 1.33 \text{ feet}$$

Precipitation

Table 4.1 of Title 27 requires that the waste management units (evaporation ponds) have capacity sufficient for the 1000-year, 24-hour, design storm. Table 4-2 of the ROWD indicates the rainfall associated with the design storm is 3.9 inches. This amount will be included in the freeboard to allow the evaporation ponds to be at their highest operating level and have sufficient freeboard to experience the design storm rainfall simultaneously with the design wind velocity and still not have the waves overtop the dike.

Total Freeboard

The total minimum freeboard is equal to the sum of the wave run-up and design storm precipitation, or:

$$\text{Total Required Freeboard} = 1.33 + (3.9 / 12)$$
$$= 1.65 \text{ feet}$$

Since this is less than the 2-foot minimum freeboard recommended in Title 27, the 2-foot minimum will be provided. Thus, the evaporation ponds will be operated such that the maximum water level will not exceed:

$$\text{Maximum Water Level} = 10.0 - 2.0$$
$$= 8.0 \text{ feet}$$

Operating Depth

The operating depth is that portion of the depth required to accommodate seasonal differences in concentrated brine input versus the net evaporation rate on a seasonal basis. In order to allow for seasons where the evaporation is less than average or the precipitation is greater than average, the operating depth will be assumed equal to the design annual concentrated brine flow divided by the pond area:

$$\text{Operating Depth} = \frac{\text{Annual Concentrated Brine Flow}}{\text{Pond Area}}$$

$$= 25.4 / 10$$

= 2.5 feet

Sludge Depth

Assuming a pond depth of 10.0 feet, 2.0 feet of freeboard, and an operating depth of 2.5 feet, the depth available for sludge accumulation is:

Depth Available for Sludge Accumulation = 10.0 – 2.0 – 2.5

= 5.5 feet

Sludge Production

Over the life of the EAEC, the brine in the evaporation ponds will reach saturation and precipitate salts. The rate of sludge accumulation of is a function of the total dissolved solids (TDS) in the concentrated brine. Figure B-2 indicates the depth of sludge per foot of waste as a function of the salinity of the waste. Assuming a concentrated brine salinity of 150,000 ppm, the sludge accumulation rate is estimated to be:

Annual Sludge Accumulation = (0.08)(2.5)

= 0.20 feet / year

At this rate, sludge would need to be removed from the evaporation ponds at an interval of:

Sludge Removal Interval = 5.5 / 0.20

= 27.5 years

Given that the brine flows have been conservatively estimated based on the source water quality in Year 20 and expectation of higher quality during the earlier years, it is likely that the evaporation ponds will be capable of containing the entire amount of sludge produced over the life of the EAEC. Nonetheless, the evaporation ponds will be designed with a concrete surface to allow the removal of sludge without damaging the synthetic liner system.

APPENDIX B

Engineering Calculations for Determination of Pond Capacity and Depth

REGISTERED PROFESSIONAL ENGINEER
JAMES B. McLUCAS
No 23815
MECHANICAL
STATE OF CALIFORNIA

Project Description, for additional information on the project's internal water balance). These water requirements are based on a "typical" year assuming full base-load operation for most of the year with peak operation, including combustion turbine power augmentation and HRSG duct firing, for 12 hours per day, 6 days per week, for the hottest 4 months of the year.

TABLE 7-1A
Estimated Monthly Water Requirements for EAEC – Year 1 (Typical Year assumed)

	Monthly Requirements (AF)												
Water Demand Type	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual Total**
Raw Water from BBID	306	276	306	296	306	545	563	563	545	306	296	306	4,614
Recycled water from MHCSD WWTP	0	0	0	0	0	0	0	0	0	0	0	0	0
Other (for domestic uses)[a]	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	2
Total Monthly Water Use	306	276	306	296	306	545	563	563	545	306	296	306	4,616

[a]Water for domestic purposes would come from either on-site wells or from the local domestic water treatment plant which serves Western and the other federal and state facilities.

TABLE 7-1B
Estimated Monthly Water Requirements for EAEC – Year 20 (Typical Year assumed)

	Monthly Requirements (AF)												
Water Demand Type	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual Total**
Raw Water from BBID[a]	0	0	0	26	86	385	433	408	335	16	0	0	1,753
Recycled water from MHCSD WWTP[b]	306	276	306	270	220	160	130	155	210	290	296	306	2,861
Other (for domestic uses)[c]	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	2
Total Monthly Water Use	306	276	306	296	306	545	563	563	545	306	296	306	4,616

[a]Figures represent the amount of BBID raw water that would be used assuming the MHCSD WWTP develops as conservatively assumed; more or less would be required as MHCSD recycled water is made available.

[b]Monthly figures represent the minimum amount of water that is estimated would be consistently available from the MHCSD WWTP at buildout; actual availability may be greater depending on the timing of buildout.

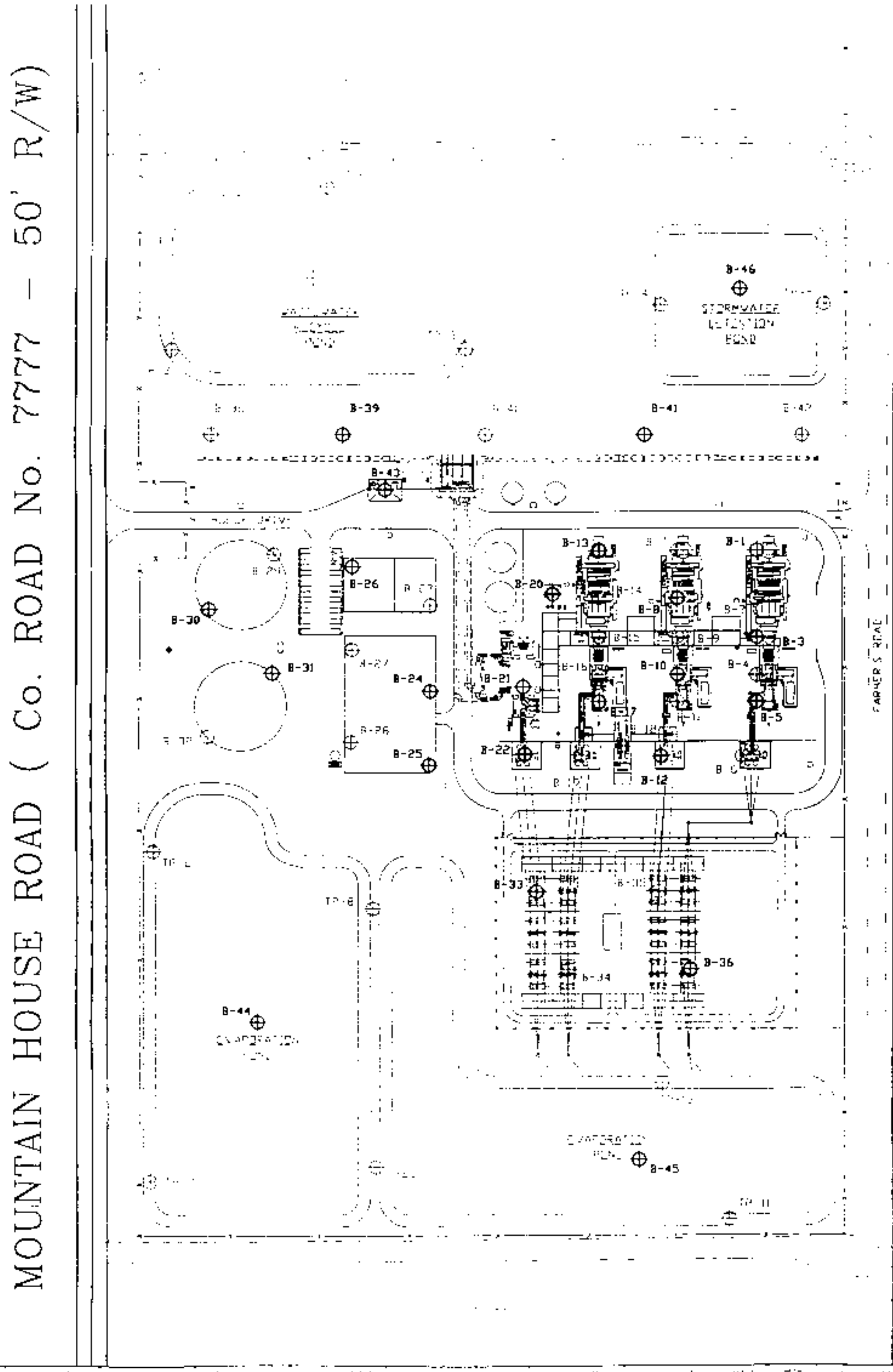
[c] Water for domestic purposes would come from either on-site wells or from the local domestic water treatment plant which serves Western and the other federal and state facilities.

7.1 Cooling Water

The proposed cooling water supply sources for the project are BBID raw water and recycled water from the MHCSD WWTP. A description of BBID's water supply and water quality is provided below, as well as the proposed infrastructure required to deliver BBID water from its existing Canal 45 turnout to the project site. A description of the MHCSD WWTP recycled water supply and proposed infrastructure to bring recycled water to the project site is also provided. This section also describes and compares the alternative pipeline routes.

APPENDIX C

Soil Borings



TEST PIT SCHEDULE		
No	COORDINATES	
TP-1	N 2117593	E 6250827
TP-2	N 2117324	E 6250570
TP-3	N 2117022	E 6250050
TP-4	N 2117391	E 6251374
TP-5	N 2117009	E 6251642
TP-6	N 2116480	E 6250529
TP-7	N 2115951	E 6250526
TP-8	N 2116395	E 6250090
TP-9	N 2115954	E 6250890
TP-10	N 2116584	E 6251339
TP-11	N 2115861	E 6251469

BORING SCHEDULE		
No	COORDINATES	
B-1	[illegible]	[illegible]
B-2	[illegible]	[illegible]
B-3	N 2116808	[illegible]
B-4	N 2116761	E 6251324
B-5	N 2116722	[illegible]
B-6	N 2116603	E 6251433
B-7	N 2116976	E 6251397
B-8	N 2116899	E 6251396
B-9	N 2116834	E 6251395
B-10	N 2116771	E 6251294
B-11	N 2116726	E 6251094
B-12	N 2116605	E 6251365
B-13	N 2116985	E 6251267
B-14	N 2116900	E 6251266
B-15	N 2116805	E 6251265
B-16	N 2116773	E 6251264
B-17	N 6116727	E 6251264
B-18	N 2116653	E 6251302
B-19	N 2116617	E 6251235
B-20	N 2116908	E 6251188
B-21	N 2116754	E 6251139

BORING SCHEDULE		
No	COORDINATES	
B-22	N 2116541	E 6251140
B-23	N 2116992	E 6250988
B-24	N 2116748	E 6250987
B-25	N 2116624	E 6250984
B-26	N 2116958	E 6250863
B-27	N 2116817	E 6250858
B-28	N 2116564	E 6250855
B-29	N 2116985	E 6250731
B-30	N 2116892	E 6250622
B-31	N 2116778	E 6250732
B-32	N 2116677	E 6250590
B-33	N 2116410	E 6251157
B-34	N 2116279	E 6251210
B-35	N 2116408	E 6251359
B-36	N 2116277	E 6251410
B-37	N 2117442	E 6250082
B-38	N 2117183	E 6250631
B-39	N 2117180	E 6250047
B-40	N 2117177	E 6251061
B-41	N 2117174	E 6251344
B-42	N 2117171	E 6251603

LEGEND

- B-01 BORING, DRILLED IN MAY 2001
- TEST PIT
- FUTURE BORING

100 0 100 200 300

SCALE IN FEET

PRELIMINARY STATUS — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS — J.A. WINTERHALTER 04/30/01 — REPRESENTS REVIEWED AND APPROVED DESIGN.

ORIGINATING PERSONNEL | PROFESSIONAL ENGINEER STAMP

DRAWN BY: KPF
CHECKED BY: V.T. AMUNDSON
LEAD DESIGNER: K.P. FEEG
ENGINEER: J.A. WINTERHALTER
PROJECT ENGINEERING MANAGER: F.G. BOUTROS
PROJECT MANAGER: F.G. BOUTROS

PARSONS

PARSONS ENERGY & CHEMICALS GROUP INC.

CLIENT/PROJECT TITLE: CALPINE EAST ALTAMONT ENERGY CENTER

SOIL BORING LOCATION PLAN

ISSUED FOR CONSTRUCTION

SCALE: 1"=100'

PARSONS DOC. NO.: EAEC-1-DW-SPJ-701-001 | REV 0

Surface Conditions:	OPEN FIELD WITH CUT HAY (1 FOOT WEST OF SURVEY MARK)	Date Completed:	5/4/2001
		Logged By:	RJO
Groundwater:	Groundwater encountered at a depth of about 11.2 feet below existing site grade.	Total Depth:	51.5 FEET

Depth (feet)	Sample Type	Sample No.	FIELD Blows/ft	FIELD Pen (tsf)	LABORATORY Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests
		3-1-1	26	>4.5							
		3-3-1	27	>4.5							
5		3-5-1	24	3.25							
10		3-10-1	8								
15		3-15-1	22	2.25							
20		3-20-1	9	0.75							
25		3-25-1	12	1.5							

Lithography

DESCRIPTION

Approximate Elevation feet (msl)

(CL) SILTY CLAY WITH SAND - Dark brown, moist, hard, scattered root, moderate plasticity

(SC) CLAYEY SAND - Brown, moist, medium dense to dense, fine to medium grained

(CL) SILTY CLAY WITH SAND - Brown, moist, hard, moderate plasticity

Grades less sand, very stiff

(SC) CLAYEY SAND - Brown, moist, loose, fine grained

(CL) SILTY CLAY WITH SAND - Brown, wet, very stiff, moderate plasticity

wet, medium stiff

Stiff

KLEINFELDER

LOG OF BORING B-3
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE

1 of 2

Drafted By: G. Gomez
Project No.: 20-4561-01
Date: 6/5/2001
File Number: 2011D045

KA 2001 2011D045.GPJ 6/5/01

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
													(CL) **SANDY CLAY** - Brown, wet, hard, moderate plasticity
30		3-30-1	26	>4.5									
													(SC) **CLAYEY SAND** - Brown, wet, hard, moderate plasticity
35		3-35-1	26										
													(CL) **SANDY CLAY** - Brown, wet, stiff, scattered sand lenses, moderate plasticity
40		3-40-1	17	1.5									
													Light brown
													(CL) **SILTY CLAY** - Brown, wet, very stiff, moderately plasticity
45		3-45-1	20	3.0									
													(CL) **SANDY CLAY** - Brown, wet, hard, moderate plasticity
50		3-50-1	22	4.5									
													Very stiff
													Boring completed at a depth of 51.5 FEET below existing site grade .
55													
60													

KLEINFELDER

LOG OF BORING B-3
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
2 of 2

Drafted By: G. Gomez
Date: 6/5/2001

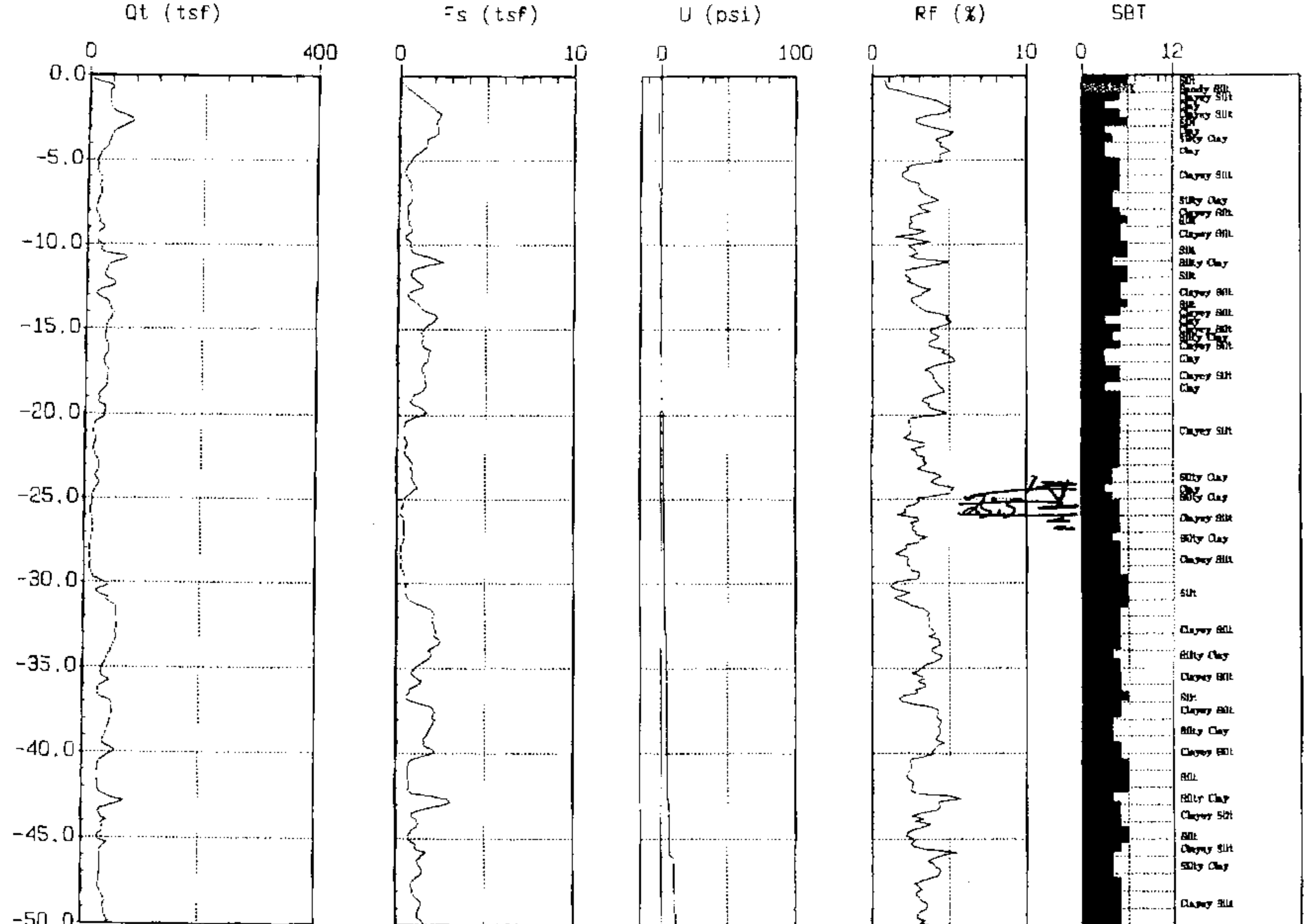
Project No.: 20-4561-01
File Number: 2011D045

GREGG

KLEINFELDER

Site : CAL.PINE
Location : B-4

Engineer: R. HEINZEN
Date : 05:03:01 07:49



Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

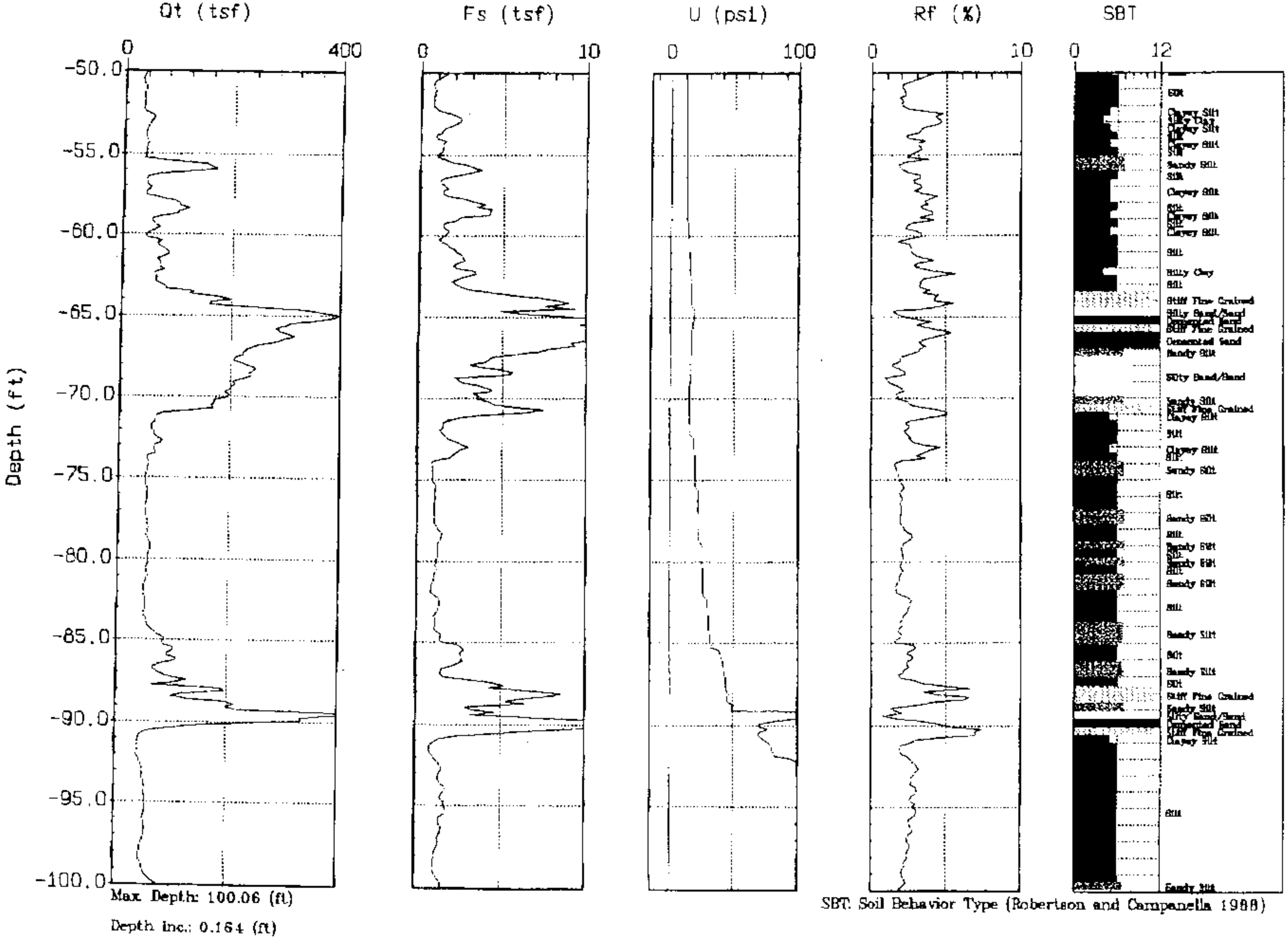
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

KLEINFELDER

Site : CA_PINE
Location : B-4

Engineer: R. HEINZEN
Date : 05:03:01 07:49



SBT: Soil Behavior Type (Robertson and Campanella 1988)

Surface Conditions:	OPEN FIELD WITH CUT HAY ON SURVEY MARK	Date Completed:	05/03/2001
		Logged By:	RJO
Groundwater:	GROUNDWATER ENCOUNTERED AT APPROXIMATE 12 FOOT DEPTH.	Total Depth:	71.5 feet

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests
		8-1-1	15	>4.5							
		8-3-1	17	3.5							
5		8-5-1	12								
10		8-10-1	12	2.5							
15		8-15-1	10	0.75							
20		8-20-1	13	<0.25							
25		8-25-1	19								

Lithography

DESCRIPTION

Approximate Elevation feet (msl)

(CL) SILTY CLAY WITH SAND - Dark brown, moist, hard, scattered roots

Brown, very stiff

(SC) CLAYEY SAND - Brown, moist, loose to medium dense, fine to medium grained

(CL) SILTY CLAY WITH SAND - Brown, very stiff

(CL) SANDY CLAY - Brown, medium stiff

(SC) CLAYEY SAND - Brown, medium dense, fine to medium grained

(CL) SILTY CLAY WITH SAND - Brown, very soft

(SC) CLAYEY SAND - Brown, medium dense, fine grained

(SP-SC) SAND WITH CLAY - Brown, medium dense, fine to medium grained

KLEINFELDER

LOG OF BORING B-8
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE

Drafted By: G. Gomez
Date: 05/11/2001
Project No.: 20-4561-01
File Number: 2011G2011G033

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
30		8-30-1	20	3.75									(CL) SILTY CLAY WITH SAND - Brown, very stiff
35		8-35-1	18										(SC) CLAYEY SAND - Brown, medium dense, fine to medium grained (SP-SC) SAND WITH CLAY - Brown, medium dense, fine to medium grained
40		8-40-1	30										Clay lenses (SM) SILTY SAND - Gray brown, medium dense, fine grained (CL) SILTY CLAY - Light olive brown, very stiff, trace sand
45		8-45-1	13	2.25									(ML) CLAYEY SILT WITH SAND - Olive brown, hard
50		8-50-1	35	3.5 TO >4.5									(CL) SILTY CLAY WITH SAND - Olive gray, very stiff (SC) CLAYEY SAND - Gray brown, dense, fine grained
55		8-55-1	42	4.0									(CL) SILTY CLAY - Olive gray, hard (SC) CLAYEY SAND - Gray brown, very dense, scattered mica, fine grained
60													

KLEINFELDER

LOG OF BORING B-8
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
2 of 3

Drafted By: G. Gomez
Date: 05/11/2001
Project No.: 20-4561-01
File Number: 2011G2011G033

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
		8-60-1	73										
													(SM) **SILTY SAND** - Gray brown, very dense, scattered mica, fine grained
65		8-65-1	71										
													(SC) **CLAYEY SAND** - Gray brown, very dense, scattered mica, fine grained
													(CL) **SILTY CLAY** - Olive gray, hard
70		8-70-1	30	4.0									
75													
80													
85													
90													

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LOG OF BORING B-8
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
3 of 3

Drafted By: G. Gomez
Date: 05/11/2001

Project No.: 20-4561-01
File Number: 2011G2011G033

KA_2001 2011G033.GPJ 5/11/01

Surface Conditions: OPEN FIELD WITH CUT HAY 1 FOOT EAST OF SURVEY MARK

Groundwater: GROUNDWATER ENCOUNTERED AT APPROXIMATE 12 FOOT DEPTH.

Date Completed: 05/04/2001

Logged By: RJO

Total Depth: 101.5 feet

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
													(CL) SILTY CLAY WITH SAND - Dark brown, moist, hard, scattered roots, medium plasticity
		10-1-1	19	>4.5									
		10-3-1	19	3.5									Brown, very stiff
5		10-5-1	17	2.5									
													(SC) CLAYEY SAND - Brown, moist, loose, fine to medium grained
10		10-10-1	8	1.75									
													(CL) SANDY CLAY - Brown, moist, stiff, medium plasticity
											∇		
													Very stiff
15		10-15-1	12	2.25 to 3.0									
													(CL) SILTY CLAY WITH SAND - Brown, moist, very stiff, medium plasticity
													(CL) SANDY CLAY - Brown, wet, very soft, medium plasticity
20		10-21-1	8	0.75									
25		10-25-1	21	3.25									**(CL) SILTY CLAY WITH SAND** - Brown, wet, very stiff, medium plasticity

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Drafted By: G. Gomez
Date: 05/10/2001

Project No.: 20-4561-01
File Number: 2011G2011G033

LOG OF BORING B-10
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
1 of 4

KA_2001 2011G033.GPJ 5/10/01

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
													(SC) CLAYEY SAND - Gray brown, wet, medium dense
30		10-30-1	16										
													Brown
35		10-35-1	17										
													(CL) SILTY CLAY - Brown, wet, hard, medium plasticity
													(SC) CLAYEY SAND - Brown, wet, medium dense, fine grained
40		10-40-1	13	2.0									
													(CL) SILTY CLAY WITH SAND - Olive brown, wet, stiff to very stiff, medium plasticity
													(SC) CLAYEY SAND - Brown, wet, loose to medium dense, fine grained
45		10-45-1	10	1.75									
													(CL) SILTY CLAY WITH SAND - Olive brown, wet, stiff, medium plasticity
													(SC) CLAYEY SAND - Gray brown, wet, loose ot medium dense, fine grained
50		10-50-1	10	2.25									**(CL) SANDY CLAY** - brown, wet, very stiff, medium plasticity
													(SC) CLAYEY SAND - Gray brown, wet, fine grained
55		10-55-1	13	1.25									**(CL) SANDY CLAY** - Brown, wet, stiff, medium plasticity
													(CL) SILTY CLAY WITH SAND - Olive brown, wet, very stiff, medium plasticity
60													

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LOG OF BORING B-10
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE

Drafted By: G. Gomez
Date: 05/10/2001
Project No.: 20-4561-01
File Number: 2011G2011G033

KA_2001 2011G033.GPJ 5/10/01

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION / Approximate Elevation feet (msl)
		10-60-1	19										**(SP-SC) SAND WITH CLAY** - Gray brown, wet, medium dense, scattered mica, fine grained
													(SP) SAND - Gray brown, wet, dense, scattered mica, fine grained
65		10-65-1	31										
													(CL) SANDY CLAY Olive gray, wet, hard, medium plasticity
70		10-70-1	26										
													(SC) CLAYEY SAND - Gray brown, wet, fine grained
75		10-75-1	63	4.25									**(CL) SANDY CLAY** - Olive brown, wet, hard, medium plasticity
													Red brown, very stiff
80		10--80-1	52	3.75									
													Hard
85		10-85-1	50 for 4"	>4.5									
90		10-90-1	25	4.5									**(SC) CLAYEY SAND** - Brown, wet, medium dense, fine grained
													(CL) SANDY CLAY - Brown, wet, hard, medium plasticity

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LOG OF BORING B-10
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
3 of 4

Drafted By: G. Gomez
Date: 05/10/2001
Project No.: 20-4561-01
File Number: 2011G2011G033

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION
													Approximate Elevation feet (msl)
													(CL) SILTY CLAY WITH SAND - Brown, wet, very stiff, medium plasticity
95		10-95-1	52										
													(CL) SANDY CLAY - Brown, moist, hard, medium plasticity
100		10-100-1	49										
105													
110													
115													
120													

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LOG OF BORING B-10
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE 4 of 4

Drafted By: G. Gomez
Date: 05/10/2001
Project No.: 20-4561-01
File Number: 2011G2011G033

Surface Conditions: FIELD WITH CUT HAY (4 FEET WEST OF SURVEY MARK)

Groundwater: Groundwater encountered at a depth of about 12 feet below existing site grade.

Date Completed: 5/2/2001

Logged By: RJO

Total Depth: 71.5 FEET

Depth (feet)	Sample No.	Blows/ft	Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	DESCRIPTION Approximate Elevation feet (msl)
0											**(CL) SILTY CLAY WITH SAND** - Dark brown, moist, hard, scattered roots, moderate plasticity
	13-1-1	16	>1.5								
											Brown
	13-3-1	29	>4.5								
5	13-5-1	23	1.75								
											(CL) SANDY CLAY - Brown, moist, stiff, moderate plasticity
											(SC) CLAYEY SAND - Brown, moist, loose, fine grained
10	13-10-1	4	0.75								
											(CL) SILTY CLAY - moist, medium stiff, moderate plasticity
											(CL) SILTY CLAY WITH SAND - Brown, wet, medium stiff, moderate plasticity
15	13-15-1	10	0.75								
											(SC) CLAYEY SAND - Brown, wet, medium density, with clay layers, fine to medium grained
20	13-20-1	13									
											(CL) SILTY CLAY WITH SAND - Brown, wet, stiff, scattered sand, moderate plasticity
25	13-25-1	17	1.78								

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LOG OF BORING B-13
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE

Drafted By: G. Gomez
Date: 6/5/2001
Project No.: 20-4561-01
File Number: 2011D045

KA 2001 20116045.GPJ 6/5/01

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
													Hard
30		13-30-1	27	>4.5									
													(CL) **SANDY CLAY** - Brown, wet, hard, moderate plasticity
35		13-35-1	28	>4.5									
													(SP-SM) **SAND WITH SILT** - Gray brown, wet, dense, fine grained
40		13-40-1	56										
45		13-45-1	42	2.5									(CL) **SILTY CLAY WITH SAND** - Brown, wet, very stiff, moderate plasticity
													(CL) **SILTY CLAY** - Gray, wet, hard, slightly cemented, moderate plasticity
50		13-50-1	50	>4.5									
													(SP) **SAND** - Gray brown, wet, dense, fine to medium grained
55		13-55-1	50										(SM) **SILTY SAND** - Brown, wet, dense, scattered mica, fine grained
60													

KLEINFELDER

Drafted By: G. Gomez
Date: 6/5/2001

Project No.: 20-4561-01
File Number: 2011D045

LOG OF BORING B-13
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
2 of 3

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
		13-60-1											
65		13-65-1	53										(CL) **SILTY CLAY** - Gray, wet, hard, moderately cemented, moderate plasticity
													(SC) **CLAYEY SAND** - Light brown, wet, very dense, fine grained
70		13-70-1	65										Grades less clay
													Boring completed at a depth of 71.5 FEET below existing site grade .
75													
80													
85													
90													

KLEINFELDER

Drafted By: G. Gomez
Date: 6/5/2001

Project No.: 20-4561-01
File Number: 2011D045

LOG OF BORING B-13
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
3 of 3

Surface Conditions: FIELD WITH CUT HAY 5 FEET WEST OF STAKE (SURVEYED LOCATION)

Groundwater: GROUNDWATER ENCOUNTERED AT APPROXIMATE 12 FOOT DEPTH.

Date Completed: 05/02/2001

Logged By: RJO

Total Depth: 81.5 feet

Depth (feet)	Sample Type	Sample No. (FIELD)	Blows/ft (FIELD)	Pocket Penetrometer (tsf) (FIELD)	Dry Density (pcf) (LABORATORY)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
													(CL) SILTY CLAY WITH SAND - Dark brown, moist, hard, scatterd roots, medium placticity
		17-1-1	22	>4.5									
													Brown
		17-3-1	26	>4.5									
5													Very stiff
		17-5-1	18	2.5									
													(CL) SILTY CLAY - Brown, moist, very stiff, medium plasticity
10		17-10-1	15	2.75									
												▽	
													Wet, stiff
15		17-15-1	14	1.75									
													(CL) SANDY CLAY - Brown, wet, stiff, medium plasticity
													(SC) CLAYEY SAND - Brown, wet, dense, fine to medium grained
20		17-20-1	31	>4.5									**(CL) SILTY CLAY WITH SAND** - Brown, wet, hard, medium plasticity
													(SM) SILTY SAND - Brown, wet, loose to medium dense, fine to course grained
25		17-25-1	14	2.5									**(CL) SANDY CLAY** - Light brown, wet, very stiff, low plasticity
													(SM) SILTY SAND - Brown, wet, medium dense, fine grained

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LOG OF BORING B-17

EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
1 of

Drafted By: G. Gomez
Date: 05/10/2001

Project No.: 20-4561-01
File Number: 2011G2011G033

KA 2001 2011G033.GPJ 5/10/01

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
30		17-30-1	39	>4.5									**(CL) SILTY CLAY WITH SAND** - Brown, wet, hard, medium plasticity
													(SM) SILTY SAND - Brown, wet, hard, medium dense, fine grained
35		17-35-1	22	4.5									**(CL) SILTY CLAY WITH SAND** - Light brown, wet, hard, medium plasticity
													(SM) SILTY SAND - Brown, wet, medium dense, fine grained
40		17-40-1	17	2.5									**(CL) SANDY CLAY** - Brown, wet, very stiff, low plasticity
													(SC) CLAYEY SAND - Brown, wet, medium dense, low plasticity, fine grained
													(CL) SILTY CLAY WITH SAND - Light brown, wet, very stiff, medium plasticity
45		17-45-1	30	3.0									
													(SC) CLAY SAND - Brown, wet, medium dense, scattered mica, fine grained
50		17-50-1	44										
													(CL) SILTY CLAY - Olive gray, wet, hard, medium plasticity
55		17-55-1	37	4.5									
													(CL) SANDY CLAY - Brown, wet, very stiff, scattered mica, low plasticity
60													

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LOG OF BORING B-17
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
2 of

Drafted By: G. Gomez
Date: 05/10/2001
Project No.: 20-4561-01
File Number: 2011G2011G033

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pocket Penetrometer (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION
													Approximate Elevation feet (msl)
		17-60-1	28	3.5									
													Hard
65		17-65-1	35	4 to 4.25									(CL) **SILTY CLAY** - Olive brown, wet, hard, low to medium plasticity
70		17-70-1	39	4.25									
													(SC) **CLAYEY SAND** - Brown, wet, dense, low plasticity, fine grained
75		17-75-1	39										
													(SP-SM) **SAND WITH SILT** - Brown, wet, dense, low plasticity, poorly graded, fine graine
													(CL) **SILTY CLAY** - Light brown, wet, hard, low to medium plasticity
													Red brown
80		17-80-1	18	>4.5									(CL) **SILTY CLAY WITH SAND** - Red brown, wet, hard, low to medium plasticity
													(SC) **CLAYEY SAND** - Red brown, wet, medium dense, fine grained
85													
90													

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LOG OF BORING B-17

EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE 3 of 3

Drafted By: G. Gomez
Date: 05/10/2001

Project No.: 20-4561-01
File Number: 2011G2011G033

Surface Conditions: OPEN FIELD

Groundwater: Groundwater encountered at a depth of about 12.5 feet below existing site grade.

Date Completed: 5/29/2001

Logged By: RJO

Total Depth: 20 FEET

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
0													(CL) **SILTY CLAY WITH SAND** - Dark brown, moist, hard, scattered roots, moderate plasticity
2.5													Brown
5													
6.5													(CL) **SANDY CLAY** - Dark brown, moist, very soft, moderate plasticity
7.5		44-7-1	4	<0.25									
10													
11.5													(CL) **SILTY CLAY WITH SAND** - Dark brown, moist, moderate plasticity
15.5													(CL) **SILTY CLAY** - Brown, moist, moderate plasticity
20													Boring completed at a depth of 20 FEET below existing site grade .
25													

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LOG OF BORING B-44
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE 1 of 1

Drafted By: G. Gomez
Date: 6/5/2001
Project No.: 20-4561-01
File Number: 2011D045

Surface Conditions: OPEN FIELD

Groundwater: Groundwater encountered at a depth of about 10.9 feet below existing site grade.

Date Completed: 5/4/2001

Logged By: RJO

Total Depth: 20 FEET

Depth (feet)	Sample Type	Sample No. (FIELD)	Blows/ft (FIELD)	Pen (tsf) (FIELD)	Dry Density (pcf) (LABORATORY)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
0												CL	**(CL) SILTY CLAY WITH SAND** - Dark brown, moist, hard, scattered roots, moderate plasticity
2.5													Brown
5													Stiff
10	■	45-10-2	15	1.5								▽	
17													Olive brown
20													Boring completed at a depth of 20 FEET below existing site grade .
25													

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Drafted By: G. Gomez

Date: 6/5/2001

Project No.: 20-4561-01

File Number: 2011D045

LOG OF BORING B-45

EAST ALTAMONT ENERGY CENTER

ALAMEDA COUNTY, CALIFORNIA

PLATE

1 of 1

Surface Conditions: OPEN FIELD

Groundwater: Groundwater encountered at a depth of about 11.5 feet below existing site grade.

Date Completed: 5/29/2001

Logged By: RJO

Total Depth: 20 FEET

Depth (feet)	Sample Type	Sample No.	Blows/ft	Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing #4 Sieve (%)	Passing #200 Sieve (%)	Other Tests	Lithography	DESCRIPTION Approximate Elevation feet (msl)
													(CL) SILTY CLAY WITH SAND - Dark brown, moist, hard, scattered roots, moderate plasticity
													Brown
													(ML) SANDY SILT - Brown, moist, very stiff, low plasticity
5		46-5-1	15	2.25									
													(CL) SANDY CLAY - Brown, moist, stiff, moderate plasticity
													(CL) SILTY CLAY WITH SAND - Brown, moist, moderate plasticity
10													
													(CL) SILTY CLAY - Brown, moist, moderate plasticity
15													**(CL) SILTY CLAY WITH SAND** - Brown, moist, moderate plasticity
													Olive brown
20													Boring completed at a depth of 20 FEET below existing site grade .
25													

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LOG OF BORING B-46
EAST ALTAMONT ENERGY CENTER
ALAMEDA COUNTY, CALIFORNIA

PLATE
1 of 1

Drafted By: G. Gomez
Date: 6/5/2001

Project No.: 20-4561-01
File Number: 2011D045

KA 2001 2011D045.GPJ 6/5/01

APPENDIX D

Stability Analysis Data

Results of CPT Soundings
Results of Verified Compressive Strength Tests
Grachical Results of Stability Analysis

KLEINFELDER

File No. 20-4561-01.G01
June 7, 2001

Ms. Toni Pezzetti
CH2M Hill
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

Subject: **RESULTS OF SLOPE STABILITY ANALYSES**
EVAPORATION AND WASTEWATER RECYCLE PONDS
EAST ALTAMONT ENERGY CENTER – ALAMEDA COUNTY, CA

Dear Ms. Pezzetti:

Attached are the results of the slope stability analyses performed for the evaporation and wastewater recycle ponds at the East Altamont Energy Center project. These plates and figures were referenced in our letter dated June 6, 2001.

Respectfully submitted,

KLEINFELDER, INC.

Ron Heinzen, G.E.
Regional Manager/Senior Principal

REGISTERED PROFESSIONAL ENGINEER
RONALD TERRY HEINZEN
No. 388
Exp. 3-31-03
GEOTECHNICAL
STATE OF CALIFORNIA

RTH:lr
Attachments

KLEINFELDER 2825 East Myrtle Street, Stockton, CA 95205-4794 (209) 948-1345 (209) 948-0621 fax

KLEINFELDER

File No. 20-4561-01.G01
June 6, 2001

Ms. Toni Pezzetti
CH2M Hill
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

Subject: **SUMMARY OF SLOPE STABILITY ANALYSES**
EVAPORATION AND WASTEWATER RECYCLE PONDS
EAST ALTAMONT ENERGY CENTER - ALAMEDA COUNTY, CA

Dear Ms. Pezzetti:

Presented in this letter is a summary of slope stability analyses performed for the evaporation and wastewater recycle ponds at the East Altamont Energy Center project located in Alameda County, California. As you are aware, our firm completed forty-six borings and CPT soundings and eleven backhoe test pits within the project site. The borings located within the evaporation and wastewater recycle ponds were previously submitted. Our field explorations suggest a relatively uniform soil profile in the upper approximate 15 feet which would be affected by the pond construction. Atterberg limits tests performed at depths of 1, 5, and 10 feet indicated plasticity indices of 20, 28, and 20, respectively. For simplicity, we have used a single soil profile of silty clay/clayey silt. We have attached the results of several CPT soundings from near the pond locations (B-34, B-35, B-38, and B-40) which indicate undrained shear strength in excess of 1,000 pounds per square foot (psf). We have also included results of unconfined compressive strength tests on samples from the 3 to 15 foot depths which also indicated shear strengths in excess of 1,000 psf.

The static and pseudo-static slope stability of the embankment was analyzed using simplified circular arc limit equilibrium procedures and the computer program SlopeW by GEO-SLOPE International. This program can model circular arch failures surfaces in accordance with Spencer, Bishop's, and Morganstern-Price methods and COE criteria. The stability evaluation methods first assume a trial circular failure surface through the embankment. The soil mass located above the failure surface is then divided into a series of vertical slices for ease of analysis, and resisting and driving forces acting on each slice are determined. These forces include the soil weight, the pore pressure, the effective normal force on the base, the mobilized shear force (including both cohesion and friction), and the horizontal side forces due to earth pressures. The stability of the embankment along the trial failure surface is estimated based on the factor of safety or ratio of moment resisting forces (soil strength, etc.) to moment driving forces (soil weight, pore pressures, etc.). The analysis is continued by assuming various trial failure surfaces until a minimum factor of safety or critical failure surface is determined.

For our evaluation of end of construction conditions, we assume the ponds would be empty. Since the ponds will be occasionally emptied for maintenance, the most severe, long-term loading

KLEINFELDER 2825 East Myrtle Street, Stockton, CA 95205-4794 (209) 948-1345 (209) 948-0621 fax

condition would also be with no water. In other words, the placement of water in the ponds for long-term analyses would only increase the computed factors of safety since the weight of water would resist overturning forces. Any additional support provided by the 6- to 8-inch thick concrete mat on the bottom and side slopes has been neglected. We have assumed that material excavated from the pond area would be used to raise the grade around the evaporation and wastewater recycle ponds. For the purpose of our analyses, we have assumed that the ground surface would be raised approximately 5 feet surrounding the ponds which would place groundwater more than 5 feet below the bottom of the ponds. In our opinion, groundwater at this depth would have insignificant impact on our stability analyses. As mentioned above, the soil parameters used in our analyses were based on our evaluation of the material type and density, laboratory index properties, and results of laboratory strength tests. The consistency or relative densities of the soils were also based on field penetration tests. An average moist unit weight of 125 pounds per cubic foot (pcf) was used for the native clay soil. An undrained shear strength of 1,000 psf was used for the end of construction conditions. For long-term stability, an angle of internal friction of 20° was added to our soil profile and the undrained strength reduced to a very conservative value of 200 psf.

The results of earthquake analyses are critically dependent on the value of the horizontal seismic coefficients. The vertical seismic coefficient typically has little influence on the determined embankment factor of safety and was thus neglected. In recognition that the embankment is not rigid and that the peak acceleration exists for only a short time, Marcuson (1981) suggested that appropriate horizontal seismic coefficients for levees and dams should correspond to one-third to one-half of the maximum acceleration, including amplification or deamplification effects to which the embankment is subjected. Similarly, Hynes and Franklin (1984) applied the Newmark sliding block analysis to over 360 accelerograms and concluded that earth dams with pseudo-static factors of safety greater than 1.0 using a horizontal seismic coefficient of one-half the maximum acceleration and a 20 percent reduction in shear strength would not develop "dangerously large" deformations. Accordingly, for the purpose of our analysis, a horizontal seismic coefficient of 0.225, corresponding to one-half the peak ground acceleration determined by the Calfed Bay-Delta Program report (1998), was selected. The shear strength data was not reduced by 20 percent since the values selected already are considered very conservative.

The graphical results of our stability analysis for each condition are on the attached plates. The computer printouts of our stability analyses can be provided if needed. A review of our analyses shows that the proposed embankment should be very stable under all conditions with factors of safety exceeding 1.48 for seismic conditions and 2.8 for static conditions.

We trust this summarizes our recent discussions and presents the information requested. If you have any questions or need additional information, please contact us.

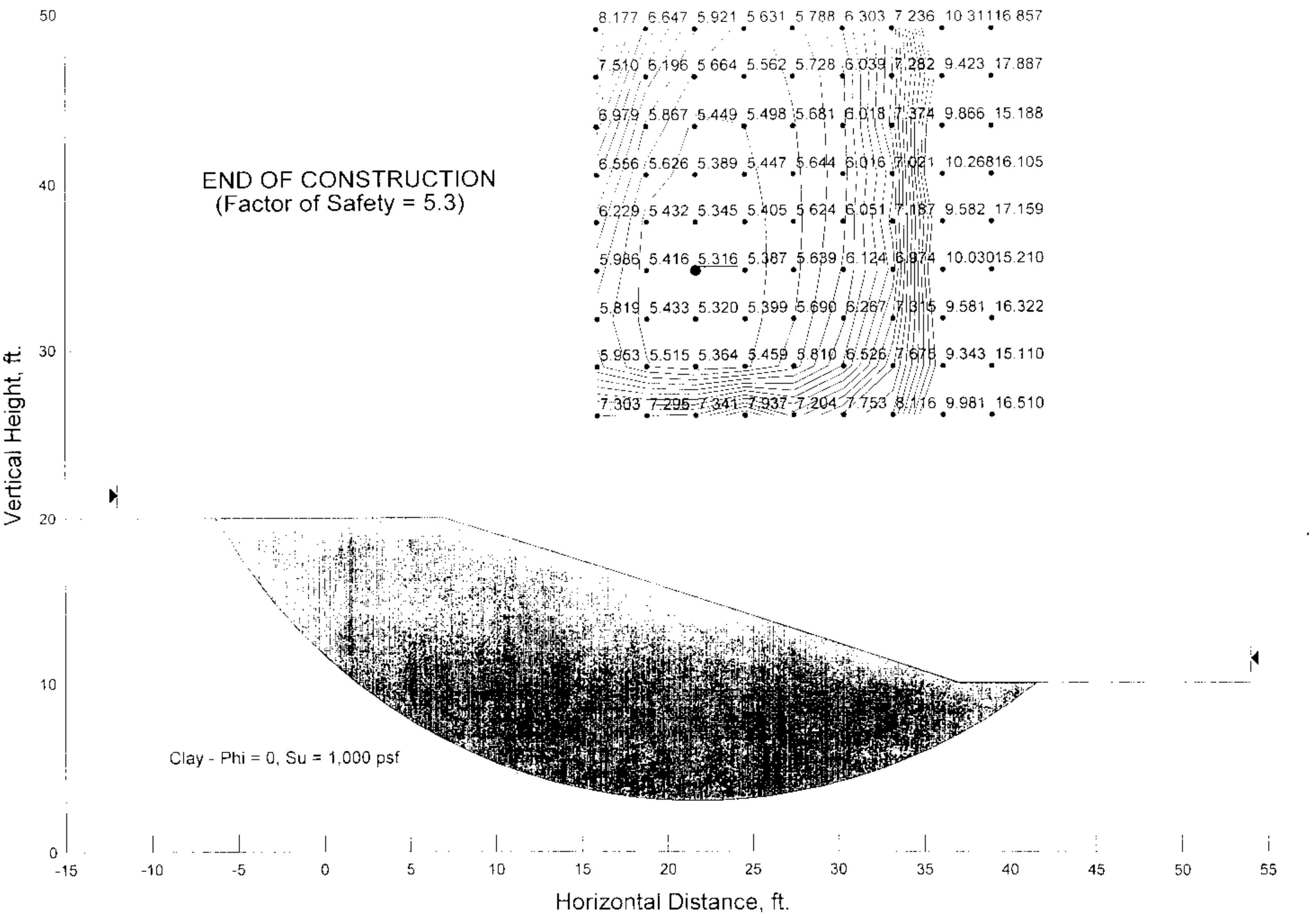
Respectfully submitted,

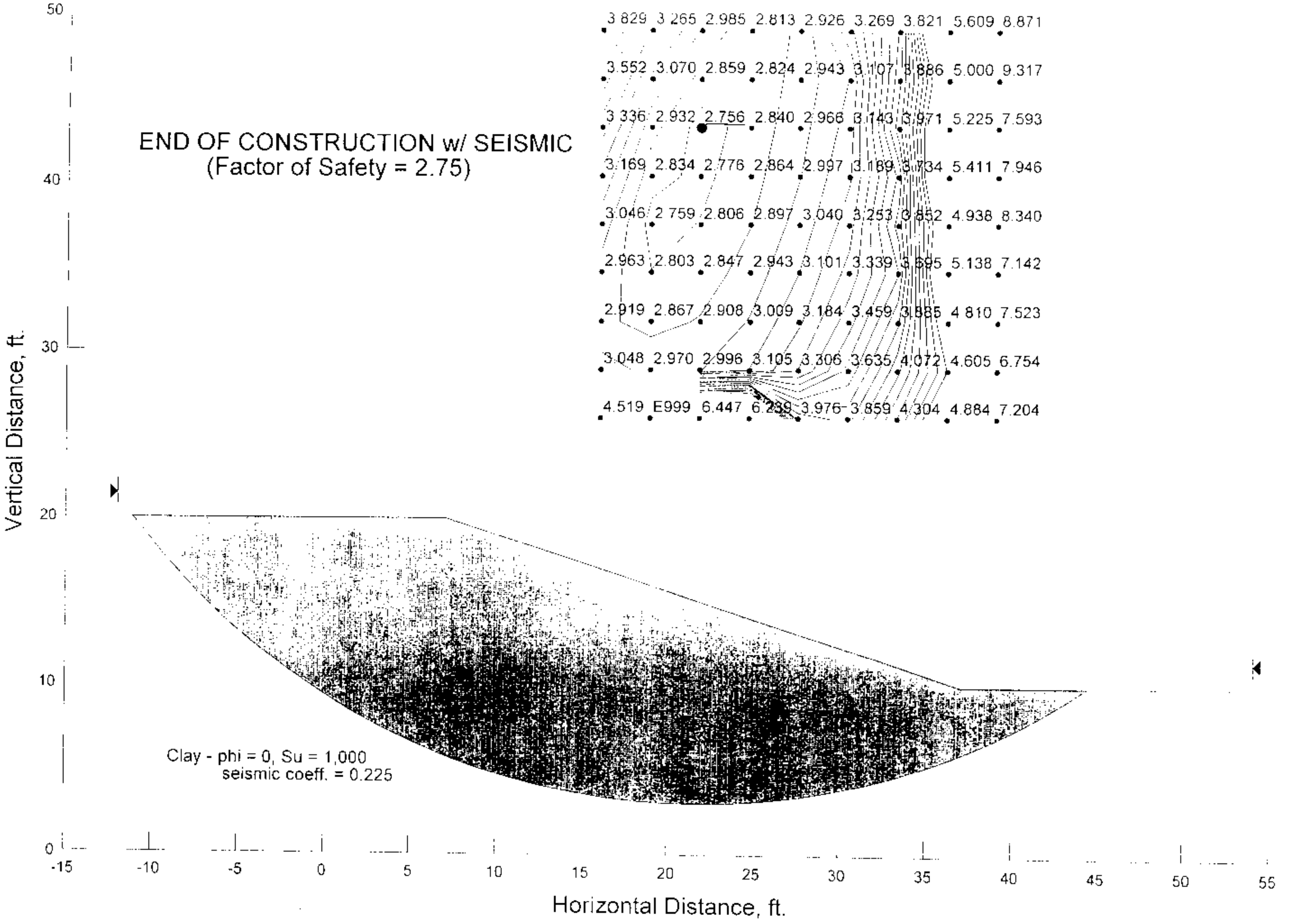
KLEINFELDER, INC.

Ron Heinzen, G.E.
Regional Manager/Senior Principal

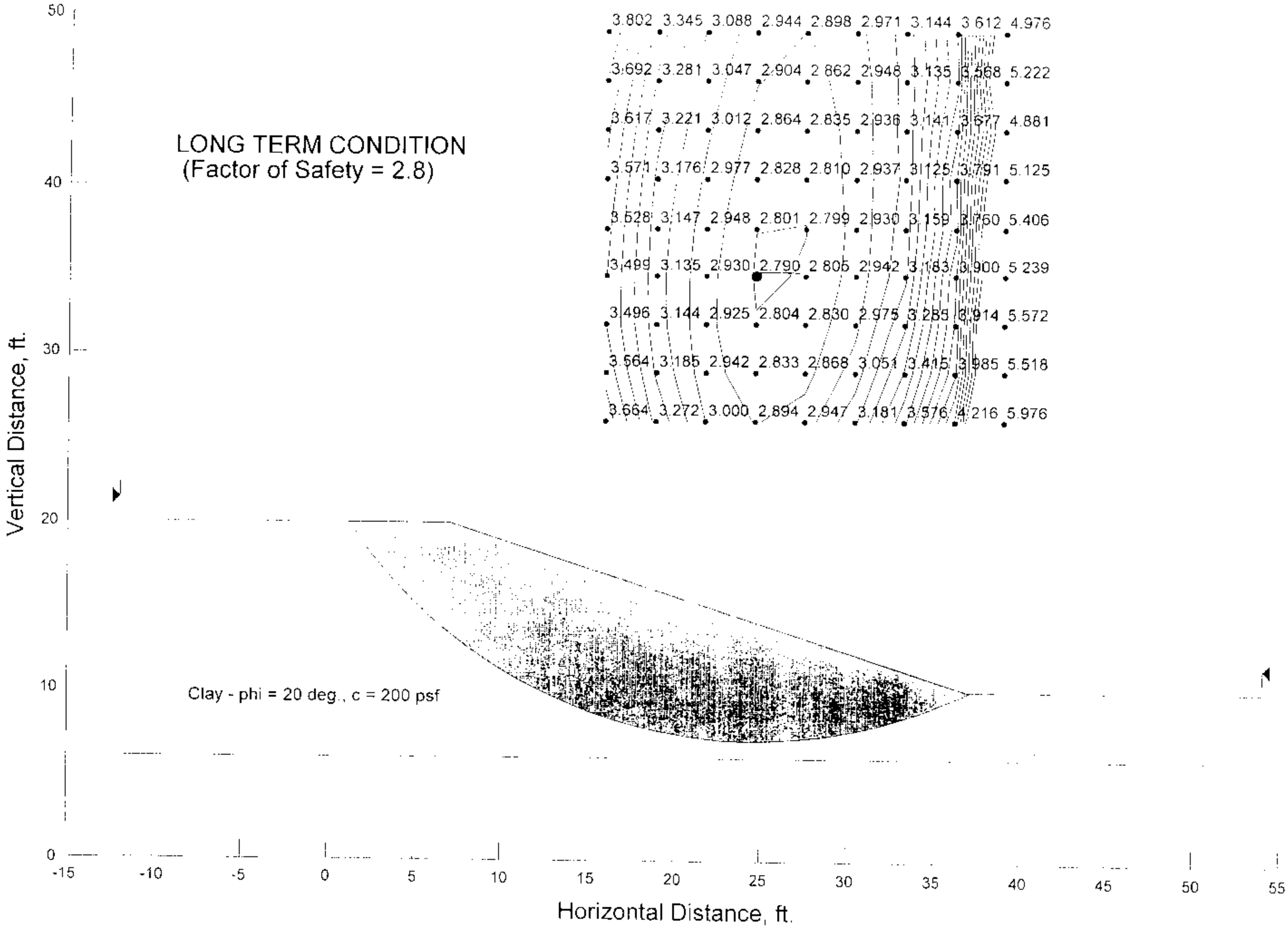
REGISTERED PROFESSIONAL ENGINEER
RONALD TERRY HEINZEN
No. 388
Exp. 3-31-03
GEOTECHNICAL
STATE OF CALIFORNIA

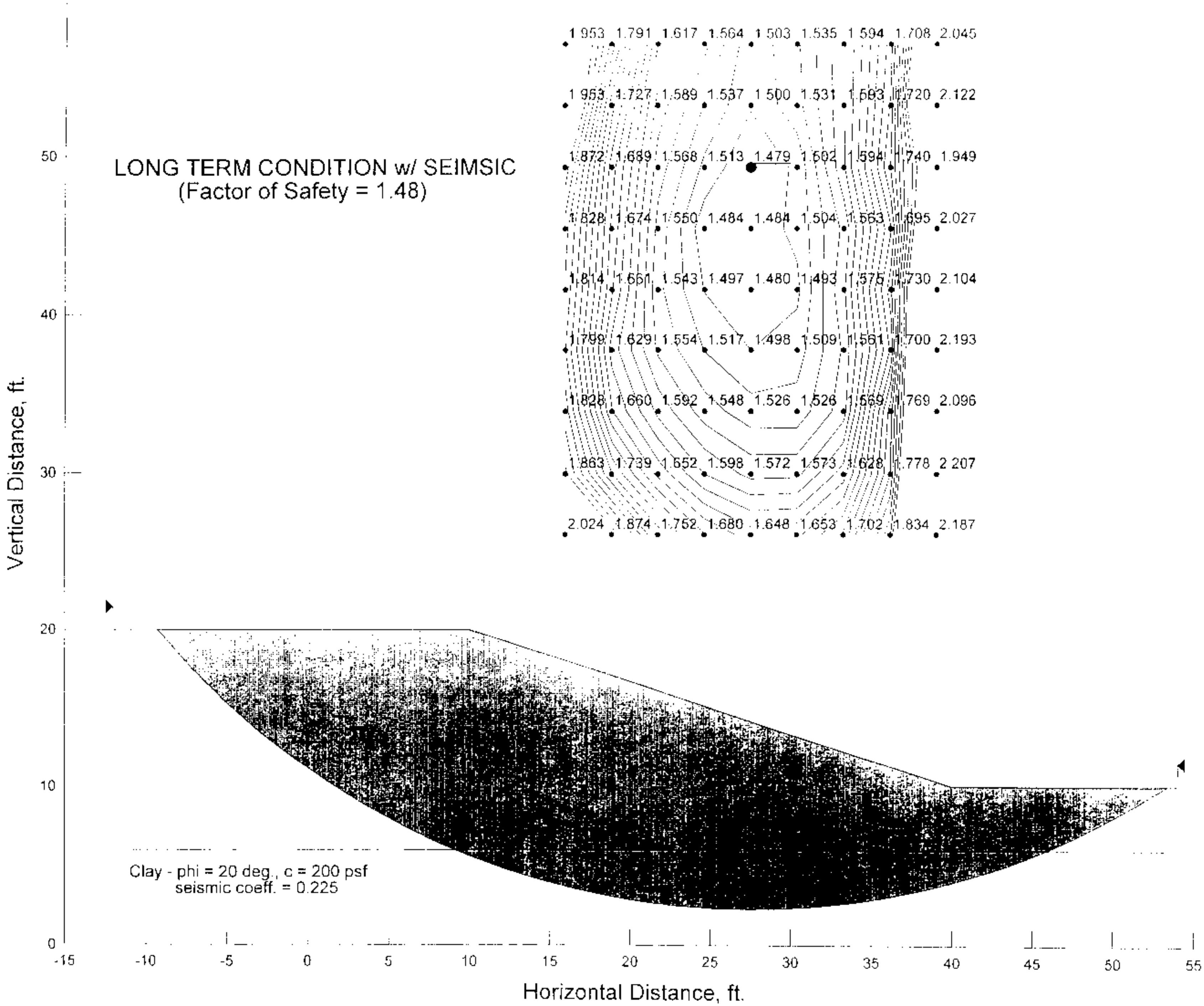
RTH:lr Attachment


END OF CONSTRUCTION
(Factor of Safety = 5.3)
8.177 6.647 5.921 5.631 5.788 6.303 7.236 10.311 16.857
7.510 6.196 5.664 5.562 5.728 6.039 7.282 9.423 17.887
6.979 5.867 5.449 5.498 5.681 6.018 7.374 9.866 15.188
6.556 5.626 5.389 5.447 5.644 6.016 7.021 10.268 16.105
6.229 5.432 5.345 5.405 5.624 6.051 7.187 9.582 17.159
5.986 5.416 5.316 5.387 5.639 6.124 6.974 10.030 15.210
5.819 5.433 5.320 5.399 5.690 6.267 7.315 9.581 16.322
5.963 5.515 5.364 5.459 5.810 6.526 7.675 9.343 15.110
7.303 7.295 7.341 7.937 7.204 7.753 8.116 9.981 16.510
Clay - Phi = 0, Su = 1,000 psf
Vertical Height, ft.
50
40
30
20
10
0
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
Horizontal Distance, ft.



END OF CONSTRUCTION w/ SEISMIC
(Factor of Safety = 2.75)
3.829 3.265 2.985 2.813 2.926 3.269 3.821 5.609 8.871
3.552 3.070 2.859 2.824 2.943 3.107 3.886 5.000 9.317
3.336 2.932 2.756 2.840 2.966 3.143 3.971 5.225 7.593
3.169 2.834 2.776 2.864 2.997 3.169 3.734 5.411 7.946
3.046 2.759 2.806 2.897 3.040 3.253 3.852 4.938 8.340
2.963 2.803 2.847 2.943 3.101 3.339 3.595 5.138 7.142
2.919 2.867 2.908 3.009 3.184 3.459 3.885 4.810 7.523
3.048 2.970 2.996 3.105 3.306 3.635 4.072 4.605 6.754
4.519 E999 6.447 6.239 3.976 3.859 4.304 4.884 7.204
Clay - phi = 0, Su = 1,000
seismic coeff. = 0.225
Vertical Distance, ft.
50
40
30
20
10
0
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
Horizontal Distance, ft.


LONG TERM CONDITION
(Factor of Safety = 2.8)
Clay - phi = 20 deg., c = 200 psf
Vertical Distance, ft.
Horizontal Distance, ft.
3.802 3.345 3.088 2.944 2.898 2.971 3.144 3.612 4.976
3.692 3.281 3.047 2.904 2.862 2.948 3.135 3.568 5.222
3.617 3.221 3.012 2.864 2.835 2.936 3.141 3.677 4.881
3.571 3.176 2.977 2.828 2.810 2.937 3.125 3.791 5.125
3.528 3.147 2.948 2.801 2.799 2.930 3.159 3.760 5.406
3.499 3.135 2.930 2.790 2.805 2.942 3.183 3.900 5.239
3.496 3.144 2.925 2.804 2.830 2.975 3.285 3.914 5.572
3.564 3.185 2.942 2.833 2.868 3.051 3.415 3.985 5.518
3.664 3.272 3.000 2.894 2.947 3.181 3.576 4.216 5.976



LONG TERM CONDITION w/ SEIMSIC
(Factor of Safety = 1.48)
1.953 1.791 1.617 1.564 1.503 1.535 1.594 1.708 2.045
1.953 1.727 1.589 1.537 1.500 1.531 1.593 1.720 2.122
1.872 1.689 1.568 1.513 1.479 1.502 1.594 1.740 1.949
1.828 1.674 1.550 1.484 1.484 1.504 1.563 1.695 2.027
1.814 1.661 1.543 1.497 1.480 1.493 1.575 1.730 2.104
1.799 1.629 1.554 1.517 1.498 1.509 1.561 1.700 2.193
1.828 1.660 1.592 1.548 1.526 1.526 1.569 1.769 2.096
1.863 1.739 1.652 1.598 1.572 1.573 1.628 1.778 2.207
2.024 1.874 1.752 1.680 1.648 1.653 1.702 1.834 2.187
Clay - phi = 20 deg., c = 200 psf
seismic coeff. = 0.225
Vertical Distance, ft.
Horizontal Distance, ft.

Gregg In Situ, Inc.
Interpretation Output Release 1.00.19c
Run No: 01 0509-2133 3389
Job No 97-100
Client. KLEINFELDER
Project Calpine Energy, East Altamont Energy Center
Site: CALPINE
Location B-34
Engineer: R. HEINZEN
CPT Date. 01/03/05
CPT Time: 12:15
CPT File 068B34 COR

Water Table (m): (ft):
Averaging Increment (m): 0.30
Su Nkt used. 15 00
Phi Method : Robertson and Campanella, 1983
Dr Method : Jamiolkowski - All Sands
Used Unit Weights Assigned to Soil Zones

Depth (ft)	Depth (m)	AvgQt (tsf)	AvgFs (tsf)	AvgRf (%)	E.Stress (tsf)	Hyd. Pr. (tsf)	N60 (blows/ft)	(N1)60 (blows/ft)	Delta (N1)60	(N1)60 CS	Su (tsf)	CRR	Dr (%)	Phi (deg)	OCR (ratio)	SBT
0.49	0 15	47.739	0.020	0.0	0.030	0.000	11.4	22.8	0.0	22.8	0.000	0.15	95.0	50.0	1.0	8
1.48	0.45	89.122	0.677	0.8	0.089	0.000	21.3	42.7	0.0	42.7	0.000	0.00	95.0	50.0	1.0	8
2.46	0.75	75.873	1.281	1.7	0.148	0.000	24.2	48.4	0.0	48.4	0 000	0.37	86.1	48.0	1.0	7
3.44	1.05	63.660	1.422	2.2	0.205	0.000	24.4	48.8	3.7	52.5	4.230	0.32	76.4	46.0	10.0	6
4 43	1.35	44.252	1.041	2.4	0.262	0.000	17.0	33.1	5.5	38.7	2.933	0.20	62.5	44.0	10 0	6
5.41	1.65	44.564	1.196	2.7	0.318	0.000	17.1	30.3	7.1	37.4	2.950	0.21	59.9	44.0	10.0	6
6.40	1.95	50.234	1.444	2.9	0.374	0.000	19.2	31.5	8.3	39.7	3.324	0.24	61.0	44.0	10.0	6
7.30	2.22	44.956	1.331	3.0	0.426	0.000	17.2	26.4	8.9	35.3	2.969	0.21	56.0	42.0	10.0	6
8.20	2.50	43.213	1.452	3.4	0.478	0.000	20.7	29.9	13.1	43 0	2.849	0.24	0.0	0.0	10.0	5
9.19	2.80	48.337	1.460	3.0	0.534	0.000	18.5	25.3	10.0	35.3	3.187	0.23	54.8	47.0	10.0	6
10.17	3.10	39.666	1.248	3.1	0.590	0.000	19.0	24.7	13.2	37.9	2.605	0.22	0.0	0.0	10.0	5
11.15	3.40	37.284	1.158	3.1	0.647	0.000	17.9	22.2	13.5	35.7	2.443	0.22	0.0	0.0	6.0	5
12.14	3.70	48.245	1.733	3.6	0.703	0.000	23.1	27.5	16.3	43.9	3 169	0.33	0.0	0.0	10 0	5
13.21	4.02	21.897	0.719	3.3	0.764	0.000	10.5	12.0	12.0	24.0	1.409	0.25	0.0	0.0	6.0	5
14.27	4.35	36.677	1.101	3.0	0.825	0.000	17.6	19.3	14.7	34.0	2.390	0.27	0.0	0.0	6.0	5
15.26	4.65	44.891	1.976	4.4	0.882	0.000	28.7	30.5	29.2	59.7	2.934	0.00	0.0	0.0	6.0	4
16.24	4.95	27.365	1.363	5.0	0.937	0.000	26.2	27.1	0.0	27.1	1.762	0.00	0.0	0.0	6.0	3
17.22	5.25	31.828	1 164	3.7	0.993	0.000	15.2	15.3	15.3	30.6	2.056	0.43	0.0	0.0	6.0	5
18.21	5.55	28.037	1.139	4.1	1.049	0.000	17.9	17 5	17.5	35.0	1.799	0.30	0.0	0.0	6.0	4
19.19	5.85	27.412	1.006	3.7	1.106	0.000	13.1	12.5	12.5	25.0	1.754	0.27	0.0	0 0	6.0	5
20.18	6.15	27.658	1.159	4.2	1.162	0.000	17.7	16.4	0.0	16.4	1.766	0.00	0.0	0.0	6.0	4
21.16	6.45	17.055	0.491	2.9	1.219	0.000	8.2	7.4	7.4	14.8	1.056	0.12	0.0	0.0	3.0	5
22.15	6.75	14.522	0.394	2.7	1.275	0.000	7.0	6.2	6.2	12.3	0.883	0.10	0.0	0.0	3.0	5
23.13	7.05	12.015	0.254	2.1	1.327	0.004	5.8	5.0	5.0	10.0	0.712	0.09	0.0	0 0	3.0	5
24.11	7.35	17.513	0.326	1.9	1.353	0.035	6.7	5.8	5.8	11.5	1.075	0.12	30 0	30 0	3.0	6
25.10	7.65	27.262	0.678	2.5	1.379	0.066	10.4	8 9	8.9	17.8	1.721	0.22	30.0	32.0	6.0	6
26.08	7.95	47.494	1.372	2.9	1.404	0.096	18.2	15.4	15.1	30.5	3 066	0.00	40.4	36.0	6.0	6
27.07	8.25	29.842	1.180	4.0	1.430	0.127	19.1	15.9	0.0	15.9	1.886	0.00	0.0	0.0	6.0	4
28.05	8.55	25.052	0.779	3.1	1.456	0.158	12.0	9.9	9.9	19.9	1.563	0.18	0.0	0.0	6.0	5
29.04	8.85	31.989	0.789	2.5	1.481	0.188	12.3	10 1	10.1	20.1	2.021	0.28	30.0	34.0	6.0	6

Gregg In Situ, Inc
Interpretation Output - Release 1.00.19c
Run No: 01-0509-2123-3394
Job No: 97-100
Client: KLEINFELDER
Project: Calpine Energy, East Altamont Energy Center
Site: CALPINE
Location: B 35
Engineer: R HEINDEN
CPT Date: 01/03/05
CPT Time: 12:36
CPT File: 068B35.COR

Water Table (m): (ft):
Averaging Increment (m): 0.30
Su Nkt used: 15.00
Phi Method : Robertson and Campanella, 1983
Dr Method : Jamiolkowski - All Sands
Used Unit Weights Assigned to Soil Zones

Depth (ft)	Depth (m)	AvgQt (tsf)	AvgFs (tsf)	AvgRf (%)	E.Stress (tsf)	Hyd. Pr. (tsf)	N60 (blows/ft)	(N1)60 (blows/ft)	Delta (N1)60	(N1)60 CS	Su (tsf)	CRR	Dr (%)	Phi (deg)	OCR (ratio)	SBT
0.49	0.15	42.679	0.775	1.8	0.029	0.000	13.6	27.2	0.0	27.2	0.000	0.00	93.0	50.0	1.0	7
1.48	0.45	50.335	2.214	4.4	0.086	0.000	24.1	48.2	0.0	48.2	3.350	0.00	0.0	0.0	10.0	5
2.46	0.75	58.815	3.313	5.6	0.146	0.000	56.3	112.7	0.0	112.7	0.000	0.00	79.0	48.0	1.0	11
3.44	1.05	34.909	1.778	5.1	0.206	0.000	33.4	66.9	0.0	66.9	2.314	0.00	0.0	0.0	10.0	3
4.43	1.35	35.957	1.687	4.7	0.261	0.000	34.4	67.4	0.0	67.4	2.380	0.00	0.0	0.0	10.0	3
5.41	1.65	29.042	1.298	4.5	0.316	0.000	27.8	49.5	0.0	49.5	1.915	0.00	0.0	0.0	10.0	3
6.40	1.95	25.105	0.824	3.3	0.371	0.000	12.0	19.7	10.9	30.6	1.649	0.16	0.0	0.0	10.0	5
7.38	2.22	25.030	0.720	2.9	0.423	0.000	12.0	18.4	10.2	28.6	1.640	0.14	0.0	0.0	6.0	5
8.20	2.50	37.171	1.312	3.5	0.475	0.000	17.8	25.8	13.4	39.2	2.446	0.23	0.0	0.0	10.0	5
9.19	2.80	27.762	1.253	4.5	0.530	0.000	26.6	36.5	34.9	71.4	1.815	0.00	0.0	0.0	6.0	3
10.17	3.10	22.026	0.890	4.0	0.586	0.000	14.1	18.4	18.4	36.7	1.429	0.34	0.0	0.0	6.0	4
11.15	3.40	17.038	0.750	4.4	0.641	0.000	16.3	20.4	0.0	20.4	1.093	0.00	0.0	0.0	6.0	3
12.14	3.70	12.863	0.428	3.3	0.697	0.000	8.2	9.8	9.6	19.7	0.811	0.12	0.0	0.0	6.0	4
13.21	4.02	13.690	0.392	2.9	0.758	0.000	6.6	7.5	7.5	15.1	0.862	0.12	0.0	0.0	6.0	5
14.27	4.35	24.322	0.655	2.7	0.819	0.000	11.6	12.9	12.9	25.7	1.567	0.29	0.0	0.0	6.0	5
15.26	4.65	30.903	1.001	3.2	0.876	0.000	14.8	15.8	15.8	31.6	2.002	0.00	0.0	0.0	6.0	5
16.24	4.95	35.114	1.193	3.4	0.932	0.000	16.8	17.4	17.4	34.8	2.279	0.00	0.0	0.0	6.0	5
17.22	5.25	32.338	1.016	3.1	0.988	0.000	15.5	15.6	15.6	31.2	2.090	0.45	0.0	0.0	6.0	5
18.21	5.55	33.959	1.029	3.0	1.045	0.000	16.3	15.9	15.9	31.8	2.194	0.00	0.0	0.0	6.0	5
19.19	5.85	44.227	1.808	4.1	1.101	0.000	21.2	20.2	20.2	40.4	2.875	0.00	0.0	0.0	6.0	5
20.18	6.15	35.915	1.604	4.5	1.157	0.000	22.9	21.3	21.3	42.6	2.317	0.00	0.0	0.0	6.0	4
21.16	6.45	39.582	1.729	4.4	1.214	0.000	25.3	22.9	22.9	45.9	2.558	0.00	0.0	0.0	6.0	4
22.15	6.75	34.506	1.392	4.0	1.270	0.000	22.0	19.5	19.5	39.1	2.216	0.39	0.0	0.0	6.0	4
23.13	7.05	28.701	0.901	3.1	1.323	0.004	13.7	12.0	12.0	23.9	1.825	0.25	0.0	0.0	6.0	5
24.11	7.35	19.696	0.642	3.3	1.348	0.035	9.4	8.1	8.1	16.2	1.221	0.13	0.0	0.0	3.0	5
25.10	7.65	31.144	1.236	4.0	1.374	0.066	19.9	17.0	17.0	33.9	1.980	0.28	0.0	0.0	6.0	4
26.08	7.95	37.269	1.677	4.5	1.400	0.096	23.8	20.1	0.0	20.1	2.385	0.00	0.0	0.0	6.0	4
27.07	8.25	76.919	2.078	2.7	1.425	0.127	29.5	24.7	14.2	38.8	5.024	0.40	54.1	40.0	6.0	6
28.05	8.55	64.863	2.372	3.7	1.451	0.158	31.1	25.8	23.5	49.3	4.218	0.00	0.0	0.0	6.0	5
29.04	8.85	160.274	4.975	3.1	1.477	0.188	61.4	50.5	17.4	68.0	10.574	0.00	74.6	42.0	10.0	6

Gregg In Situ, Inc.
Interpretation Output - Release 1.00.19c
Run No: 01-0509-2123-3471
Job No: 97-100
Client: KLEINFELDER
Project: Calpine Energy, East Altamont Energy Center
Site: CALPINE
Location: B-38
Engineer: R. HEINZEN
CPT Date: 01/03/05
CPT Time: 14:58
CPT File: 068B38.COR

Water Table (m): (ft):
Averaging Increment (m): 0.30
Su Nkt used: 15.00
Phi Method : Robertson and Campanella, 1983
Dr Method : Jamiolkowski - All Sands
Used Unit Weights Assigned to Soil Zones

Depth (ft)	Depth (m)	AvgQt (tsf)	AvgFs (tsf)	AvgRf (%)	E.Stress (tsf)	Hyd. Pr. (tsf)	N60 (blows/ft)	(N1)60 (blows/ft)	Delta (N1)60	(N1)60 CS	Su (tsf)	CRR	Dr (%)	Phi (deg)	OCR (ratio)	SBT
0.49	0.15	12.408	0.441	3.6	0.028	0.000	7.9	15.8	0.0	15.6	0.825	0.00	0.0	0.0	10.0	4
1.48	0.45	41.975	1.853	4.4	0.085	0.000	26.8	53.6	0.0	53.6	2.793	0.00	0.0	0.0	10.0	4
2.46	0.75	46.915	3.509	7.5	0.140	0.000	44.9	89.9	0.0	89.9	3.118	0.00	0.0	0.0	10.0	3
3.44	1.05	27.245	2.697	9.9	0.195	0.000	26.1	52.2	0.0	52.2	1.803	0.00	0.0	0.0	10.0	3
4.43	1.35	13.002	1.129	8.7	0.250	0.000	12.5	24.9	0.0	24.9	0.850	0.00	0.0	0.0	6.0	3
5.41	1.65	22.860	1.178	5.2	0.305	0.000	21.9	39.7	0.0	39.7	1.504	0.00	0.0	0.0	10.0	3
6.40	1.95	33.347	1.716	5.1	0.359	0.000	31.9	53.3	0.0	53.3	2.199	0.00	0.0	0.0	10.0	3
7.30	2.22	33.214	1.891	5.7	0.410	0.000	31.8	49.7	0.0	49.7	2.187	0.00	0.0	0.0	10.0	3
8.22	2.50	28.479	1.584	5.6	0.460	0.000	27.3	40.2	40.2	80.4	1.866	0.00	0.0	0.0	10.0	3
9.19	2.80	24.866	0.916	3.7	0.516	0.000	15.9	22.1	18.7	40.8	1.623	0.27	0.0	0.0	6.0	4
10.17	3.10	64.956	2.386	3.7	0.572	0.000	31.1	41.1	0.0	41.1	4.292	0.00	0.0	0.0	10.0	5
11.15	3.40	40.305	1.829	4.5	0.628	0.000	25.7	32.5	25.7	58.2	2.645	0.00	0.0	0.0	10.0	4
12.14	3.70	28.465	0.852	3.0	0.685	0.000	13.6	16.5	13.4	29.9	1.852	0.24	0.0	0.0	6.0	5
13.21	4.02	33.773	1.011	3.0	0.746	0.000	16.2	18.7	13.9	32.7	2.202	0.24	0.0	0.0	6.0	5
14.27	4.35	28.517	1.138	4.0	0.807	0.000	18.2	20.3	20.3	40.5	1.847	0.43	0.0	0.0	6.0	4
15.26	4.65	16.198	0.488	3.0	0.863	0.000	7.8	8.3	8.3	16.7	1.022	0.14	0.0	0.0	6.0	5
16.24	4.95	10.963	0.256	2.3	0.920	0.000	5.2	5.5	5.5	10.9	0.670	0.10	0.0	0.0	3.0	5
17.22	5.25	19.064	0.521	2.7	0.976	0.000	9.1	9.2	9.2	18.5	1.206	0.16	0.0	0.0	6.0	5
18.21	5.55	18.278	0.515	2.8	1.032	0.000	8.8	8.6	8.6	17.2	1.150	0.14	0.0	0.0	6.0	5
19.19	5.85	24.912	0.872	3.5	1.089	0.000	11.9	11.4	11.4	22.9	1.588	0.23	0.0	0.0	6.0	5
20.18	6.15	29.048	1.113	3.8	1.145	0.000	18.5	17.3	17.3	34.7	1.860	0.30	0.0	0.0	6.0	4
21.16	6.45	43.961	1.594	3.6	1.202	0.000	21.1	19.2	19.2	38.4	2.851	0.00	0.0	0.0	6.0	5
22.15	6.75	41.516	1.970	4.7	1.258	0.000	26.5	23.6	0.0	23.6	2.684	0.00	0.0	0.0	6.0	4
23.13	7.05	65.094	2.722	4.2	1.310	0.004	31.2	27.2	25.4	52.6	4.252	0.00	0.0	0.0	6.0	5
24.11	7.35	182.910	2.234	1.2	1.338	0.035	43.8	37.9	3.2	41.1	0.000	0.00	79.8	44.0	1.0	8
25.10	7.65	90.873	1.714	1.9	1.366	0.066	29.0	24.8	8.4	33.2	0.000	0.27	59.4	40.0	1.0	7
26.08	7.95	34.393	1.258	3.7	1.392	0.096	16.5	14.0	14.0	27.9	2.194	0.35	0.0	0.0	6.0	5
27.07	8.25	19.872	0.605	3.0	1.418	0.127	9.5	8.0	8.0	16.0	1.222	0.13	0.0	0.0	3.0	5
28.05	8.55	19.038	0.473	2.5	1.443	0.158	9.1	7.6	7.6	15.2	1.162	0.12	0.0	0.0	3.0	5
29.04	8.85	27.928	0.927	3.3	1.469	0.188	13.4	11.0	11.0	22.1	1.751	0.21	0.0	0.0	6.0	5
30.02	9.15	59.626	1.694	2.8	1.495	0.219	22.8	18.7	15.2	33.9	3.861	0.00	46.1	38.0	6.0	6
31.00	9.45	32.404	0.989	3.1	1.520	0.250	15.5	12.6	12.6	25.2	2.042	0.28	0.0	0.0	6.0	5
31.99	9.75	99.306	2.316	2.3	1.547	0.281	31.7	25.5	10.9	36.4	0.000	0.39	60.2	40.0	1.0	7
32.97	10.05	196.659	3.173	1.6	1.575	0.311	47.1	37.5	5.5	43.0	0.000	0.00	79.5	42.0	1.0	8
33.96	10.35	189.397	2.291	1.2	1.604	0.342	45.3	35.8	3.8	39.7	0.000	0.00	78.2	42.0	1.0	8
34.94	10.65	298.592	4.143	1.4	1.632	0.373	71.5	56.0	3.6	59.6	0.000	0.00	91.0	44.0	1.0	8
35.92	10.95	154.377	3.545	2.3	1.660	0.404	49.3	38.2	11.3	49.5	0.000	0.00	71.8	42.0	1.0	7

Gregg In Situ, Inc.

Run No: 01-0509-2123-3421

CPT File: 066B38.COR

Depth (ft)	Depth (m)	AvgQt (tsf)	AvgFs (tsf)	AvgRf (%)	E.Stress (tsf)	Hyd. Pr. (tsf)	N60 (blows/ft)	(N1)60 (blows/ft)	Delta (N1)60	(N1)60 CS	Su (tsf)	CRR	Dr (%)	Phi (deg)	OCR (ratio)	SBT
36.91	11.25	37.035	1.058	2.9	1.687	0.434	14.2	10.9	10.9	21.8	2.328	0.33	30.7	34.0	6.0	6
37.89	11.55	36.147	0.969	2.7	1.712	0.465	13.8	10.6	10.6	21.2	2.265	0.31	30.0	34.0	6.0	6
38.88	11.85	113.944	3.243	2.8	1.738	0.496	43.6	33.1	16.6	49.7	7.447	0.00	62.5	40.0	10.0	6

Gregg In Situ, Inc.
Interpretation Output - Release 1.00.19c
Run No: 05-0509-2123-3416
Job No: 97-100
Client: KLEINFELDER
Project: Calpine Energy, East Altamont Energy Center
Site: CALPINE
Location: B-40
Engineer: R. HEINZEN
CPT Date: 01/03/05
CPT Time: 14:37
CPT File: 06B40.COR

Water Table (m): (ft):
Averaging Increment (m): 0.30
Su Nkt used: 15.00
Phi Method: Robertson and Campanella, 1983
Dr Method: Jamiolkowski - All Sands
Used Unit Weights Assigned to Soil Zones

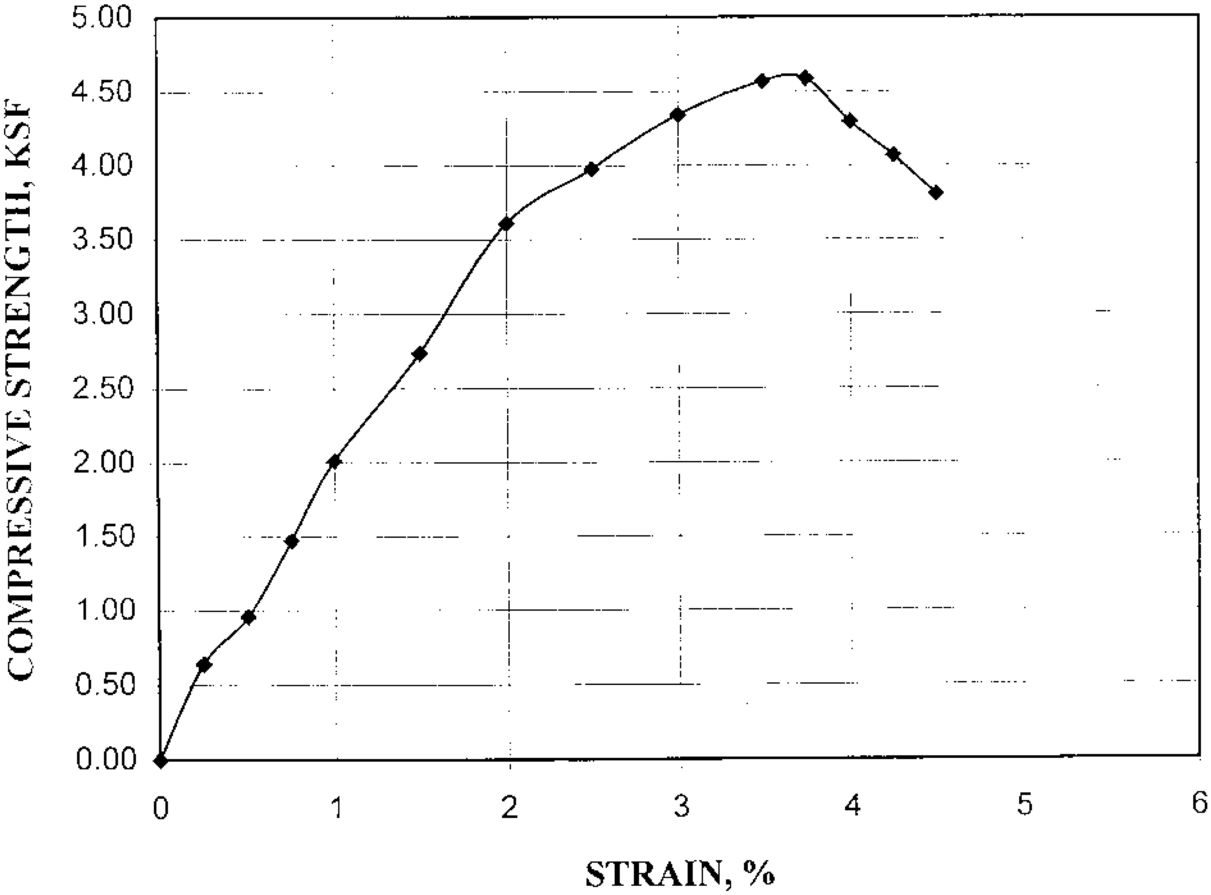
Depth (ft)	Depth (m)	AvgQt (tsf)	AvgFs (tsf)	AvgRf (%)	E.Stress (tsf)	Hyd. Pr. (tsf)	N60 (blows/ft)	(N1)60 (blows/ft)	Delta (N1)60	(N1)60 CS	Su (tsf)	CRR	Dr (%)	Phi (deg)	OCR (ratio)	SBT
0.49	0.15	31.513	0.366	1.2	0.029	0.000	10.1	20.1	0.0	20.1	0.000	0.10	84.3	50.0	1.0	7
1.48	0.45	64.637	0.919	1.4	0.087	0.000	20.6	41.3	0.0	41.3	0.000	0.26	89.2	50.0	1.0	7
2.46	0.75	71.900	1.170	1.6	0.145	0.000	23.0	45.9	0.0	45.9	0.000	0.32	84.9	48.0	1.0	7
3.44	1.05	79.711	1.286	1.6	0.203	0.000	25.4	50.9	0.6	51.5	0.000	0.43	83.0	48.0	1.0	7
4.43	1.35	46.840	0.936	2.0	0.260	0.000	17.9	35.2	4.4	39.6	3.105	0.20	64.2	44.0	10.0	6
5.41	1.65	46.283	1.764	3.8	0.316	0.000	22.2	39.4	0.0	39.4	3.064	0.00	0.0	0.0	10.0	5
6.40	1.95	37.574	1.988	5.3	0.372	0.000	36.0	59.0	0.0	59.0	2.480	0.00	0.0	0.0	10.0	3
7.30	2.22	39.980	2.017	5.0	0.422	0.000	38.3	58.9	0.0	58.9	2.637	0.00	0.0	0.0	10.0	3
8.20	2.50	29.104	1.467	5.0	0.473	0.000	27.9	40.6	37.1	77.6	1.909	0.00	0.0	0.0	10.0	3
9.19	2.80	46.996	2.053	4.4	0.528	0.000	30.0	41.3	0.0	41.3	3.098	0.00	0.0	0.0	10.0	4
10.17	3.10	54.870	2.301	4.2	0.584	0.000	26.3	34.4	0.0	34.4	3.619	0.00	0.0	0.0	10.0	5
11.15	3.40	51.462	2.108	4.1	0.641	0.000	24.6	30.8	18.1	48.8	3.388	0.42	0.0	0.0	10.0	5
12.14	3.70	34.555	1.276	3.7	0.697	0.000	16.5	19.8	16.4	36.2	2.257	0.37	0.0	0.0	6.0	5
13.23	4.02	17.810	0.520	2.9	0.758	0.000	8.5	9.8	9.8	19.6	1.137	0.17	0.0	0.0	6.0	5
14.27	4.35	43.151	1.365	3.2	0.819	0.000	20.7	22.8	15.4	38.2	2.822	0.29	0.0	0.0	6.0	5
15.26	4.65	77.183	2.962	3.8	0.876	0.000	37.0	39.5	20.1	59.6	5.087	0.00	0.0	0.0	10.0	5
16.24	4.95	63.199	2.145	3.4	0.932	0.000	30.3	31.3	17.8	49.2	4.151	0.41	0.0	0.0	10.0	5
17.22	5.25	53.154	1.793	3.4	0.989	0.000	25.5	25.6	18.0	43.6	3.478	0.42	0.0	0.0	6.0	5
18.21	5.55	32.268	0.992	3.1	1.045	0.000	15.5	15.1	15.1	30.2	2.082	0.42	0.0	0.0	6.0	5
19.19	5.85	32.340	1.380	4.3	1.101	0.000	20.6	19.7	19.7	39.4	2.083	0.40	0.0	0.0	6.0	4
20.18	6.15	26.202	1.131	4.3	1.157	0.000	25.1	23.3	0.0	23.3	1.670	0.00	0.0	0.0	6.0	3
21.16	6.45	25.247	0.750	3.0	1.213	0.000	12.1	11.0	11.0	22.0	1.602	0.21	0.0	0.0	6.0	5
22.15	6.75	45.334	1.168	2.6	1.269	0.000	17.4	15.4	12.9	28.3	2.938	0.36	40.6	36.0	6.0	6
23.13	7.05	39.920	1.164	2.9	1.321	0.004	15.3	13.3	13.3	26.6	2.573	0.00	36.3	36.0	6.0	6
24.11	7.35	35.302	0.981	2.8	1.347	0.035	13.5	11.7	11.7	23.3	2.261	0.39	32.5	34.0	6.0	6
25.10	7.65	49.331	2.028	4.1	1.373	0.066	23.6	20.2	20.2	40.3	3.193	0.00	0.0	0.0	6.0	5
26.08	7.95	38.205	1.205	3.2	1.398	0.096	18.3	15.5	15.5	30.9	2.447	0.45	0.0	0.0	6.0	5
27.07	8.25	30.917	0.799	2.6	1.424	0.127	11.8	9.9	9.9	19.9	1.958	0.27	30.0	34.0	6.0	6
28.05	8.55	42.734	1.286	3.0	1.450	0.158	16.4	13.6	13.6	27.2	2.742	0.00	37.0	36.0	6.0	6
29.04	8.85	57.559	2.459	4.3	1.475	0.188	27.6	22.7	22.7	45.4	3.726	0.00	0.0	0.0	6.0	5
30.02	9.15	44.123	1.798	4.1	1.501	0.219	21.1	17.2	17.2	34.5	2.827	0.00	0.0	0.0	6.0	5
31.00	9.45	45.520	1.769	3.9	1.527	0.250	21.8	17.6	17.6	35.3	2.916	0.00	0.0	0.0	6.0	5
31.99	9.75	28.960	1.238	4.3	1.552	0.281	18.5	14.8	0.0	14.8	1.808	0.00	0.0	0.0	6.0	4
32.97	10.05	23.401	0.682	2.9	1.578	0.311	11.2	8.9	8.9	17.8	1.434	0.15	0.0	0.0	3.0	5
33.96	10.35	22.682	0.919	4.1	1.604	0.342	14.5	11.4	0.0	11.4	1.382	0.00	0.0	0.0	3.0	4
34.94	10.65	29.577	1.263	4.3	1.629	0.373	18.9	14.8	0.0	14.8	1.836	0.00	0.0	0.0	6.0	4
35.92	10.95	22.094	0.976	4.4	1.654	0.404	21.2	16.5	0.0	16.5	1.336	0.00	0.0	0.0	3.0	3

Run No: 01 0509 2123-3416

CPT File: 068940.COR

Depth (ft)	Depth (m)	AvgQt (tsf)	AvgFs (tsf)	AvgRf (%)	E.Stress (tsf)	Hyd. Pr. (tsf)	N60 (blows/ft)	(N1)60 (blows/ft)	Delta (N1)60	(N1)60 CS	Su (tsf)	CRR	Dr (%)	PHI (deg)	OCR (ratio)	SBT
36.91	11.25	22.000	0.705	3.2	1.679	0.434	10.5	8.1	0.0	8.1	1.326	0.00	0.0	0.0	3.0	5
37.89	11.55	25.963	0.874	3.4	1.705	0.465	12.4	9.5	9.5	19.0	1.588	0.17	0.0	0.0	3.0	5
38.88	11.85	25.127	0.794	3.2	1.730	0.496	12.0	9.1	9.1	18.3	1.527	0.16	0.0	0.0	3.0	5

UNCONFINED COMPRESSIVE STRENGTH



Sample I. D. B15-5-1

Sample Data

Sample Description: Brown clayey silt

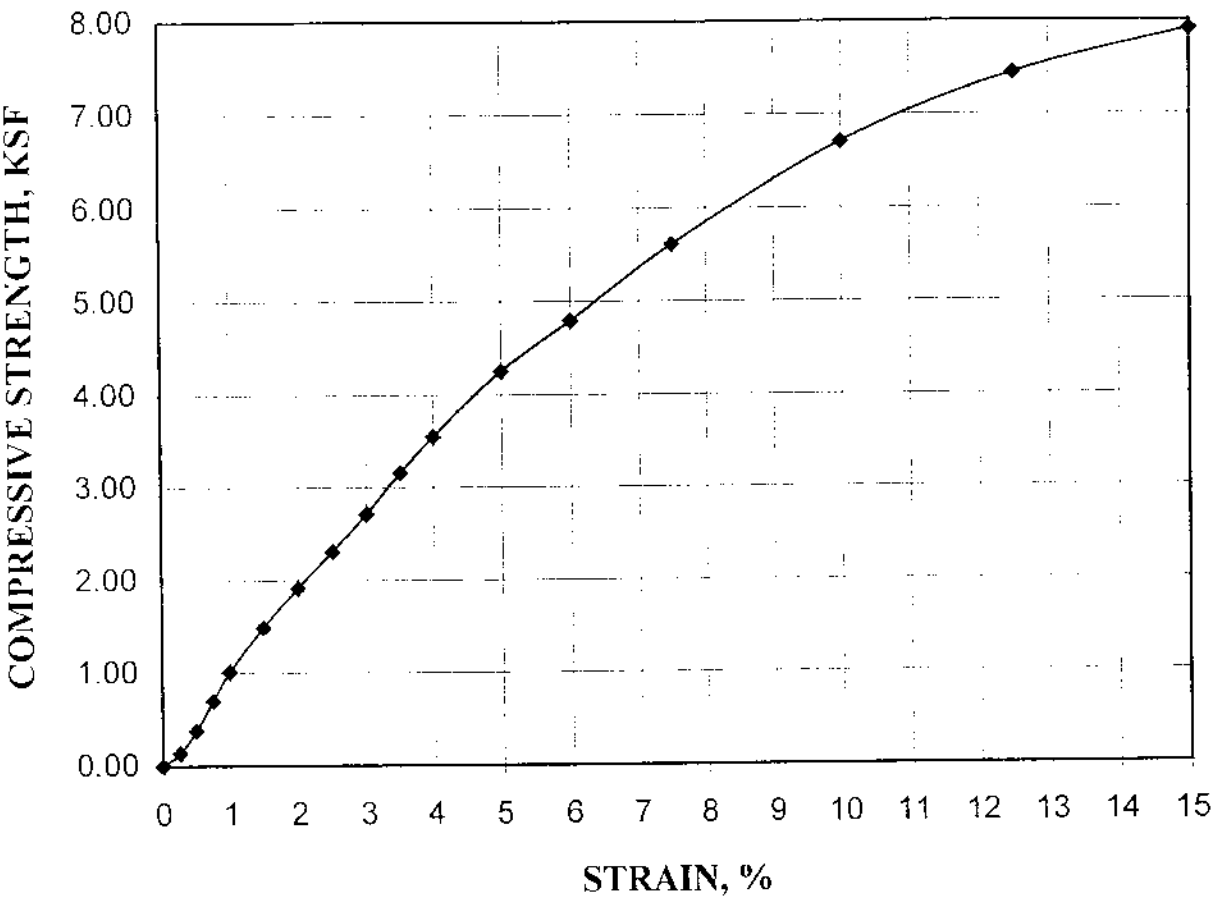
Maximum Strength: 4.6 ksf

Moisture Content: 18.9 %

Density: 105.3 pcf

Kleinfelder, Inc.		EAST ALTAMONT ENERGY CENTER	PLATE
Drafted By: EAC	File No.: 20-4561-01.G01		

UNCONFINED COMPRESSIVE STRENGTH



Sample I. D. B21-15-1

Sample Data

Sample Description: Fine Brown clay silt w/ sand

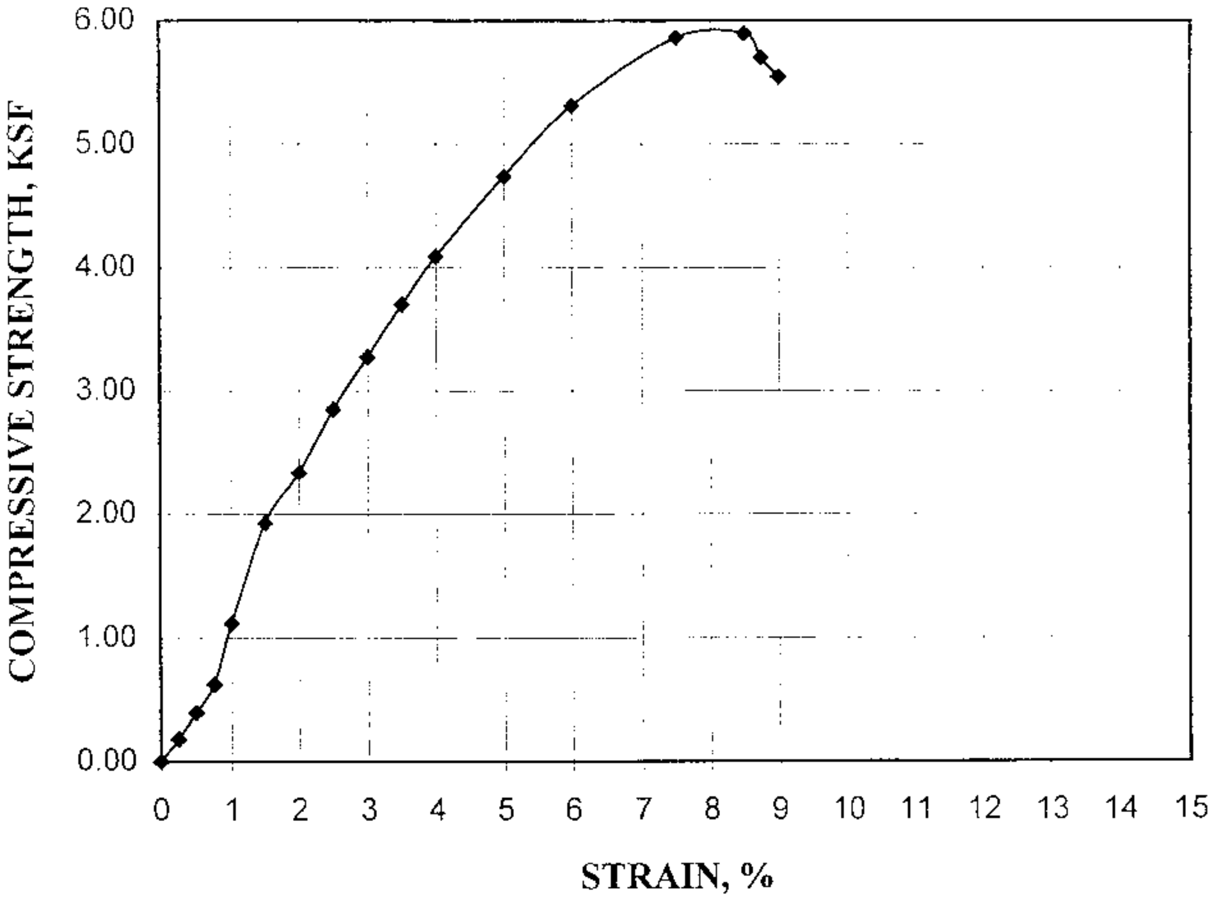
Maximum Strength: 7.9 ksf

Moisture Content: 16.4 %

Density: 113.3 pcf

Kleinfelder, Inc.	EAST ALTAMONT ENERGY CENTER	PLATE
Drafted By:EAC / File No.:20-4561-01.G01		

UNCONFINED COMPRESSIVE STRENGTH



Sample I. D. B30-10-1

Sample Data

Sample Description: Brown clayey sand
Maximum Strength: 5.9 ksf
Moisture Content: 16.5 %
Density: 108.7 pcf

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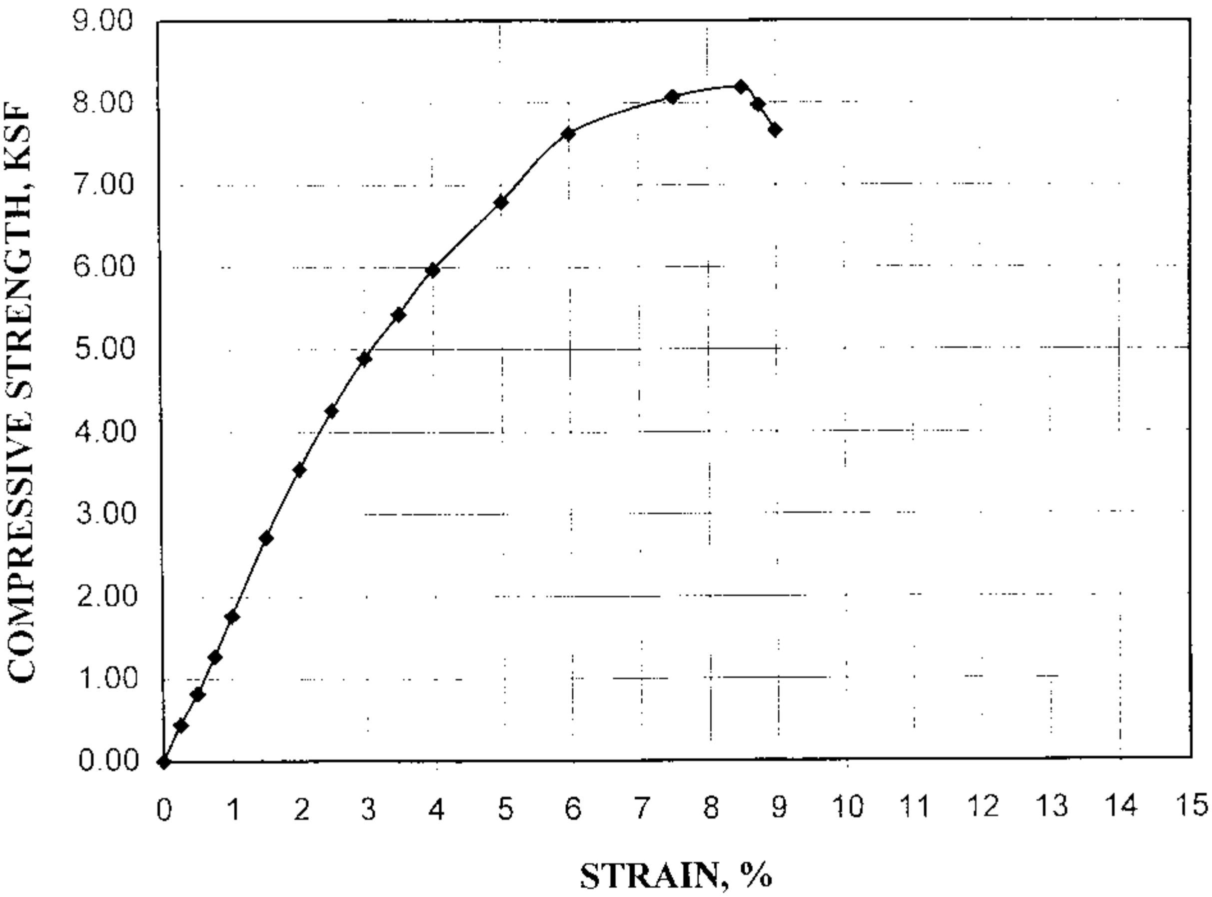
Drafted By:EAC File No.:20-4561-01		

UNCONFINED COMPRESSIVE STRENGTH



Sample I. D. B31-3-1

Sample Data

Sample Description: Brown silty clay w/ fine sand

Maximum Strength: 8.2 ksf

Moisture Content: 16.4 %

Density: 104.4 pcf

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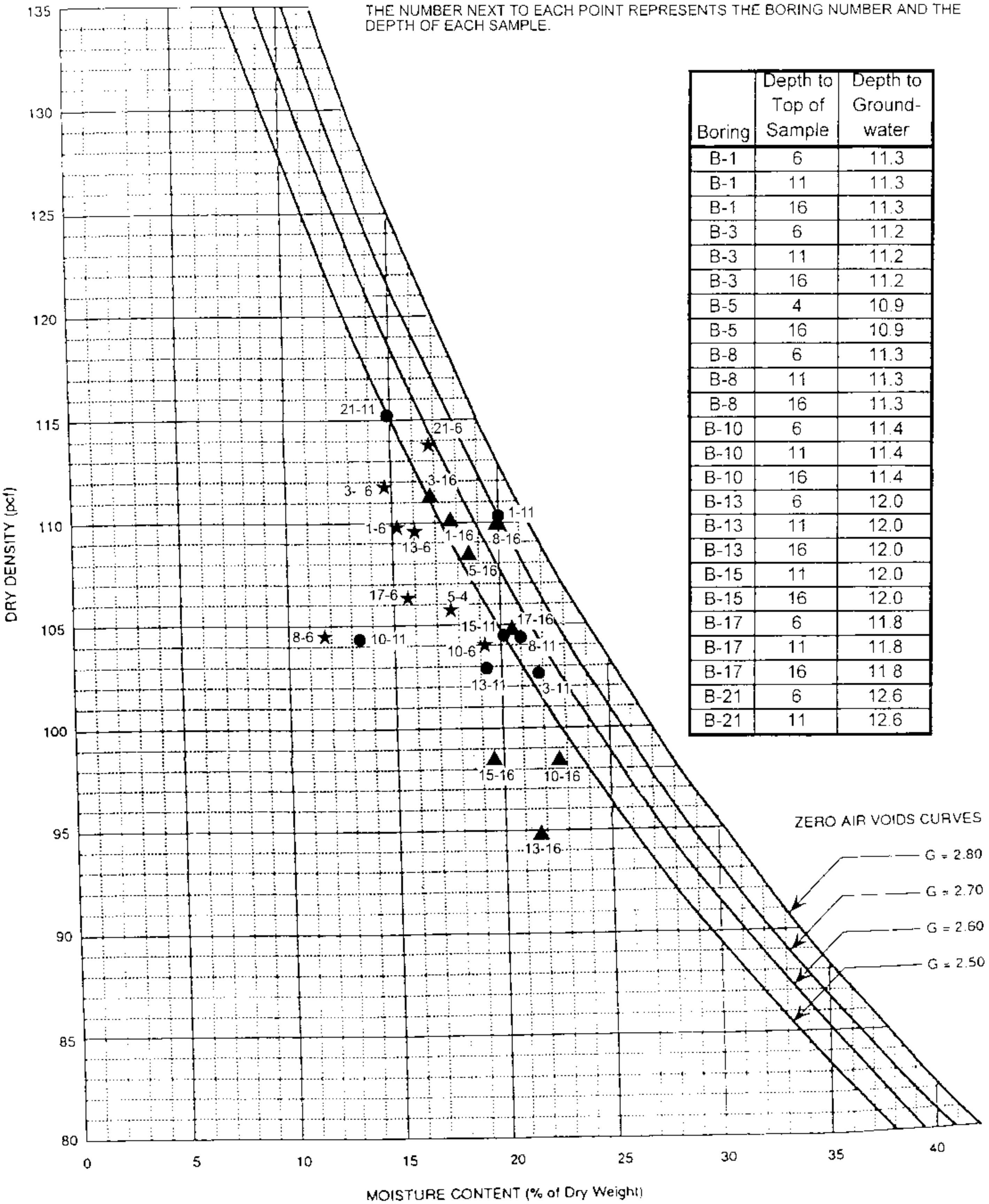
Drafted By:EAC File No :20-4561-01		

APPENDIX E

Moisture Density Plot



Boring	Depth to Top of Sample	Depth to Ground-water
B-1	6	11.3
B-1	11	11.3
B-1	16	11.3
B-3	6	11.2
B-3	11	11.2
B-3	16	11.2
B-5	4	10.9
B-5	16	10.9
B-8	6	11.3
B-8	11	11.3
B-8	16	11.3
B-10	6	11.4
B-10	11	11.4
B-10	16	11.4
B-13	6	12.0
B-13	11	12.0
B-13	16	12.0
B-15	11	12.0
B-15	16	12.0
B-17	6	11.8
B-17	11	11.8
B-17	16	11.8
B-21	6	12.6
B-21	11	12.6

KLEINFELDER

EAST ALTAMONT ENERGY CENTER
ALOMEDA COUNTY, CALIFORNIA

PLATE No

DATE PRODUCED:	DATE REVISED:
PROJ. NO.:20-4561-01.G01	FILENAME:2011D303.FH9

APPENDIX F

Shallow Groundwater Quality Data Taken From Mountain House Construction Dewatering Notice of Intent

Table 1

SYNOPSIS OF SHALLOW GROUNDWATER QUALITY IN AREA

CONSTITUENT	UNITS	Detection Level	Water Treatment Plant Site	Wastewater Treatment Plant Site	Effluent Storage Reservoir	Neighborhood F Site	Pipeline Sites	
							South	North
Aluminum (Al)	mg/L	0.05	0.37	0.29	0.29	0.55	0.22	0.2
Antimony (Sb)	μg/L	2	ND	ND	ND	ND	ND	ND
Arsenic (As)	μg/L	2	3	6	4	5	3	3
Barium (Ba)	mg/L	0.05	ND	ND	ND	0.08	0.05	ND
Beryllium (Be)	μg/L	1	ND	ND	ND	ND	ND	ND
Boron (B)	mg/L	0.1	3.6	6	5.3	3.7	3.8	5.1
Cadmium (Cd)	μg/L	1	ND	ND	ND	ND	ND	ND
Chloride (Cl)	mg/L	1	280	880	540	230	180	290
Chromium – Total (Cr)	μg/L	5	24	20	17	26	16	27
Conductivity-Specific (EC)	μmho/cm	1	2000	4300	3200	1800	1700	2200
Copper (Cu)	mg/L	0.005	0.006	0.012	0.01	0.006	0.005	0.007
Fluoride	mg/L	0.1	ND	ND	ND	ND	ND	ND
Iron (Fe)	mg/L	0.05	0.32	0.27	0.26	0.73	0.23	0.17
Lead (Pb)	μg/L	5	ND	ND	ND	ND	ND	ND
Manganese (Mn)	mg/L	0.01	0.02	0.01	0.1	0.1	0.03	ND
Mercury (Hg)	μg/L	0.4	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	μg/L	10	ND	ND	ND	ND	ND	ND
Nickel (Ni)	μg/L	10	ND	ND	ND	ND	ND	ND
Nitrate (NO3)	mg/L	1	23	ND	ND	31	ND	36
Selenium (Se) – Total	μg/L	2	7	26	21	6	4	8
Silver (Ag)	mg/L	0.01	ND	ND	ND	ND	ND	ND
Sodium (Na)	mg/L	1	340	720	570	340	300	420
Sulfate (SO4)	mg/L	2	120	740	520	110	220	200
Thallium (Tl)	μg/L	1	ND	ND	ND	ND	ND	ND
Total Dissolved Solids (TDS)	mg/L	5						
Zinc (Zn)	mg/L	0.05	ND	ND	ND	ND	ND	ND